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VOL. 35. Ser. A. Part 1. pp. 1–32. JANUARY, 1947.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE IMPERIAL INSTITUTE OF ENTOMOLOGY.

LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

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Published : November 1945.

A REVIEW OF THE LITERATURE ON SOIL INSECTICIDES.

By H. C. GOUGH, Ph.D.

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IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
OF
APPLIED ENTOMOLOGY.

SERIES A.

Vol. 35. 1947.

MOUTIA (A.). **Division of Entomology.**—*Rep. Dep. Agric. Mauritius 1944*, pp. 14–19. Port Louis, 1945.

A general survey in Mauritius in 1944 indicated that the intensity of infestation of sugar-cane by *Clemora smithi*, Arr., had changed little since the cessation of hand collection in 1937–38 [*cf. R.A.E.*, A **31** 160; **33** 370]. It was high in nine localities, of which six were centres of re-infestation and one was a new centre of infestation. The maximum population of larvae was 86,000 per acre, and the average on the heavily infested estates 19,000. The effect of infestation on yield was very considerable on some estates, even in the case of the resistant variety M. 134/32, and was increased by lack of fertilisers. Parasites were rare except in one locality, where 1,647 adults of *Campsomeris* spp. were collected. *C. lachesis*, Sauss., and *C. phalerata*, Sauss., which was previously the commonest species, represented 73·6 and 14·3 per cent. of these, respectively, the others being *C. erythrogaster*, Dalm., and *C. pilosella*, Sauss. Of 400 females of *Campsomeris* dissected, 2·4 per cent. were parasitised mainly by *Conops unicolor*, Kröb., which had probably been introduced from Madagascar. *Tiphia parallela*, Smith, which was uncommon, was examined for parasites with negative results. Outbreaks of *Proceras sacchariphagus*, Bojer, on sugar-cane were severe in some localities, where up to 70–80 per cent. of the stalks were infested by it. Attacks by *Sesamia vuteria*, Stoll, occurred late in the year. Parasites of both these borers were scarce, and *Xanthopimpla stemmator*, Thnb., which had been introduced from Ceylon [*cf.* **30** 474, etc.], was not numerous enough to permit the establishment of new colonies.

Crambus malacellus, Dup., *Prodenia litura*, F., and *Spodoptera mauritia*, Boisd., occasionally attacked young maize, but *Sesamia vuteria* was uncommon on this crop. Petrol at the rate of 17 cc. per cu. ft. was found to be a satisfactory fumigant against pests in maize seeds, and the treated seeds retained their viability when stored for 8–10 months, provided that they were aerated at least once a month, and that their moisture content did not fall below 12 per cent. An experiment showed that the moisture content could be reduced from 22 to 12 per cent. without loss of germinating power by drying for 8–9 hours at 50–52°C. [122–125°F.]. The local red bean appeared to be more resistant to attack by *Agromyza* (*Melanagromyza*) *phaseoli*, Coq., than certain dwarf and runner varieties. In tests of possible repellents, young bean plants were not

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protected by emulsions of diesel oil and clay, decoctions of tobacco or derris, or cow-dung water. Development of this Agromyzid from egg to adult required about 20 days in the laboratory ; in the field young larvae were most active in the stems 6–7 days after the appearance of the cotyledons, and some protection was given by earthing up the plants three days after the cotyledons appeared. Planting should be done when attacks are less severe, and suitable periods are suggested for various localities in the island.

Baits consisting of 1 per cent. thallium sulphate in mixtures of maize bran or sawdust and cane syrup were ineffective against *Solenopsis geminata*, F. Nearly all the plantations of *Eucalyptus* on the island were found to be heavily infested by *Gonipterus scutellatus*, Gylh., and investigations on its bionomics [**34** 101] were made. Several complaints were received of damage to constructional timbers and furniture made of local wood by *Stromatium barbatum*, F., and it is expected that attack by this Cerambycid will increase so long as local timber, such as *Eucalyptus* or *Casuarina*, is used in house construction. Termites were active, particularly in badly constructed buildings or those made of unseasoned timber.

The principal insects found on *Cordia interrupta* were *Howardia biclavis*, Comst., and *Pinnaspis minor*, Mask., on the twigs, *Brenthia leptocosma*, Meyr., and *Aphis gossypii*, Glov., on tender shoots, and *Haplothrips gowdeyi*, Franklin, on blossoms, but none of them appeared to exert any check on the spread of this weed. Larvae of *Psara bipunctalis*, F. (*mutualis*, Zell.), which was the only phytophagous insect reared from *Micania scandens*, were parasitised by *Sympiesis* sp., *Pristomerus* sp., and *Apanteles* sp., and field observations indicated that parasites prevent this Pyralid from being an important factor in the control of *Micania*, though it is sometimes abundant.

GADD (C. H.). **Report of the Entomologist for 1944.**—*Bull. Tea Res. Inst. Ceylon* no. 26 pp. 31–37. Talawakelle [1945].

A new pruning cycle was begun in September 1943 on the tea bushes at Passara, Ceylon, on which observations on the shot-hole borer [*Xyleborus fornicatus fornicatior*, Egg.] were made during the preceding three years [*cf. R.A.E.*, A **34** 71, etc.] ; the bushes were tipped on 30th December and again on 20th January 1944, and plucking began on 9th February. One new gallery of the Scolytid was found on 22nd March and ten on 19th April, 128 bushes being examined on each date. Broken branches were collected weekly from 3rd May until the end of 1944 from four blocks covering a total of 3·2 acres, and the average numbers per collection for each month are shown in a table. The numbers increased, as expected, from month to month, except for a drop in November, which was attributed to branches having been broken prematurely in mid-October, when manuring was carried out. Of the total numbers of broken branches collected by the end of July and the end of December, 74 and 64 per cent. were from one of the four blocks. The reason for this is not known, but evidence of a similar trend on this block had been obtained during the preceding cycle. Conditions within the galleries seemed favourable for breeding, and immature stages were numerous.

Several outbreaks of the tea tortrix [*Homona coffearia*, Nietn.] were reported early in the year, but investigations showed that its parasite, *Macrocentrus homonae*, Nixon, was present on every occasion. The outbreaks are attributed to low parasitism of the previous generation, and since this might have been due to insufficient food for the adult parasites, the effect of food on their survival was studied in the laboratory. The average periods were only 2–3·5 days for water alone or the nectar of various flowers, very little more for the secretions of Aphids, about a fortnight for sugar solution, nearly as long for split raisins, and from 5·5 to 17·7 days for the honey-dew of certain Coccids. This honey-dew is therefore thought to be the natural food, and since the weather in the

latter half of 1943 was unfavourable to Coccids, it may ultimately have been responsible for the outbreaks of the Tortricid.

Fortnightly observations on the abundance of nettle-grubs [Limacodids] on tea at Passara [*cf.* **33** 300] were continued until mid-June. Small numbers were found on each occasion, the species, in order of abundance, being *Natada nararia*, Moore, *Thosea cervina*, Moore, *T. recta*, Hmps., *Spatulifimbria* [*castaneiceps*, Hmps.] and *Narosa conspersa*, Wlk. Of all the larvae collected, 24 per cent. were parasitised, 9 per cent. by *Fornicia ceylonica*, Wlkn., and *Apanteles* sp. and the rest by Eulophids of the tribe EUPLECTRINI [*cf.* **34** 46]. Females of a Eulophid of the genus *Tetrastichus*, which had hitherto been thought to be a primary parasite of *Narosa* and *Natada*, did not oviposit on young unparasitised larvae of *Natada* in the laboratory, but did so readily on *Natada* parasitised by *Platyplectrus natadae*, Ferrière, the latter being in the pupal stage. The duration of development of the males in *Platyplectrus* averaged 19 days. *Fornicia ceylonica* exhibited a marked preference for larvae of *Natada* under laboratory conditions and did not parasitise those of *T. cervina* and *T. recta*, although this Braconid has occasionally been bred from field-collected larvae of both. The prepupae and pupae of *Fornicia* are parasitised by *Goryphus variibalteatus*, Cam., *Hemiteles* sp., and *Ceraphron* sp. A species of *Ceraphron*, believed to be the same, was reared from a cocoon mass of *Macrocentrus homonae* at Passara, but failed to parasitise this Braconid in the laboratory, though the other two parasites of *Fornicia* both did so. A female of *Spinaria* sp. was reared from *Thosea cervina* on tea in the Southern Province in June and survived for 99 days, during which time it was offered 90 larvae of various sizes comprising *T. cervina*, *T. recta*, *Parasa lepida*, Cram., *Natada nararia* and *Narosa conspersa*, but laid only one egg, in a fourth-instar larva of *T. recta*. The male to which this gave rise survived for 50 days and was then lost.

Defoliation of the upper branches of *Albizzia* shade trees near Hatton early in the year was found to be associated with infestation of the leaves by two mites, *Tetranychus* sp. and *Tenuipalpus obovatus*, Donn. The former was the more abundant, but the latter is known to defoliate tea and has also been associated with defoliation of *Grevillea*. An unusually severe outbreak of the *Albizzia* bark-eating borer, *Indarbela quadrinotata*, Wlk., occurred in the Rangalla district in December, when at least 1,500 trees were attacked. Adults of *Terias* (*Eurema*) *blanda silhetana*, Wallace, and *T.* (*E.*) *hecabe*, L., the two Pierids commonly associated with *Albizzia*, were abundant in the Passara district from mid-August to late December, when they disappeared; larvae of the former caused considerable defoliation of *A. sumatrana*, and, to a less extent, of *A. falcata*, but did not attack *Sesbania cinerescens*, whereas those of *T. hecabe* showed a preference for this green manure plant. *A. sumatrana* was defoliated in some fields by mid-September, and the larvae were attacking the tea bushes beneath. Attacks were severe on both species of *Albizzia* in October. *Brachymeria megaspila*, Cam., was reared from 2·7, 9·1 and 8 per cent. of pupae of *T. blanda silhetana* collected on 20th September, 23rd October and 19th November, respectively, and unidentified Tachinids from smaller percentages. *B. megaspila* was found to be a solitary primary parasite of the pupae and required 24–29 days to complete its development. An unidentified Ichneumonid that was reared from 1 per cent. of the pupae collected in September was more attracted to pupae parasitised by *B. megaspila* than to unparasitised pupae, so that it is probably a hyperparasite. No parasites were reared from pupae of *T. hecabe*.

VENKATACHARYA (B. V.). **The Light-earthing-up Technique for Control of the Sugar-cane Dead-heart Borer.**—*J. Mysore agric. exp. Un.* **19** no. 3 pp. 128–134, 2 refs. Bangalore, 1941.

Proceras (*Argyria*) *sticticraspis*, Hmps., and *P.* (*Diatraea*) *venosatus*, Wlk., are the most important pests of sugar-cane in the Irwin Canal tract of Mysore and

sometimes destroy whole crops. The first attack begins soon after the setts shoot, lasts about a fortnight and is followed by a second 2–3 weeks later. Injury is greatest on gravel soil and on the crop planted in March–April. Control by cutting out the dead-hearts or collecting the egg-masses is impracticable, but satisfactory results are given by lightly earthing up the setts as soon as they shoot, and again about three weeks later [*R.A.E.*, A **24** 242; **25** 598]. Detailed instructions for carrying out this operation are given, and its advantages and disadvantages are discussed. Since the eggs are laid soon after the shoots appear and hatch in about a week, the measures must be applied promptly, and precautions to ensure even germination of the setts are described. Under normal conditions, it reduces the percentage infestation to 3–5.

BAGAL (S. R.) & TREHAN (K. N.). **Life-history and Bionomics of two predaceous and one mycophagous Species of Coccinellidae.**—*J. Bombay nat. Hist. Soc.* **45** no. 4 pp. 566–575, 1 pl., 18 refs. Bombay, 1945.

The authors describe all stages and the reproductive systems of *Chilomenes sexmaculata*, F., and *Coccinella septempunctata*, L., which are predacious on Aphids in the Poona district of Bombay, and give a list of the plants on which they have been observed. They occur on a variety of crops from June to February, but are commonest on lucerne in summer. During hot weather, adults of both species have also been observed feeding on young nymphs of *Peregrinus maidis*, Ashm. (*Pundaluoya simplicia*, Dist.) on sorghum. The eggs are laid in batches on the lower surface of leaves; the largest numbers laid by individual females of *Chilomenes* and *Coccinella* in the laboratory were 2,384 and 3,765 in about 10 and 11½ weeks, respectively.

The average durations of egg, larval and pupal stages at different seasons of the year were within the range of 3–4, 4–15 and 3–6 days, and 15 generations of both species were reared between August 1938 and June 1939. In nature, they are usually found in association, *Chilomenes* always outnumbering *Coccinella*. The figures given for the maximum numbers of Aphids consumed by individual larvae and by pairs of adults of *Chilomenes* are 303 and 16,321, with an average of 60·84 per adult per day, and the corresponding figures for *Coccinella* are 420, 22,574 and 106·29. Under controlled conditions, 75 adults of *Chilomenes* destroyed all the Aphids on five heavily infested cabbages.

CAMERON (A. E.). **Insect and other Pests of 1943.**—*Trans. Highl. agric. Soc. Scot.* (5) **56** pp. 37–61, 5 figs., 16 refs. Edinburgh, 1944.

One of the most injurious of the insects observed in Scotland in 1943 was *Myzus persicae*, Sulz., a severe outbreak of which occurred on cruciferous crops and potatoes in the Lothians [*cf. R.A.E.*, A **29** 381] in July, following warm dry weather in June. It was terminated by rain in August, but crop losses were substantial. The Aphids migrated to various crops, and symptoms of virus yellows were observed, for the first time in Scotland, in adjacent fields of sugar-beet and mangel. The percentage of the crops infected was 50–100 in the area of infestation and negligible elsewhere. The virus is also transmitted by *Aphis fabae*, Scop. [*cf.* **31** 227], but as this Aphid was very rare on the crops concerned, *M. persicae* is thought to have been the vector, although it was absent from some fields in which a late-season spread of the disease occurred [*cf.* **34** 113]. Since beet is not grown for seed in Scotland and the alternative hosts of the virus are annual weeds it is thought to overwinter in stored mangels and ground-keeper beets, and the latter should be destroyed in fields that have been infected. Observations on the overwintering population of *M. persicae* were

made in January 1944 in south-east Scotland after two nights on which temperatures of about 25°F. had been recorded. Immature forms in all stages, with numerous mature apterae and a few alatae, were found immobilised by the cold on the under side of basal leaves of savoy cabbages and brussels sprouts, suggesting that reproduction had been proceeding prior to the frost, and that the population may actually increase in mild winters. The basal leaves of savoy cabbages should therefore be composted or buried when crops are cut in winter.

Other pests recorded include *Caradrina clavipalpis*, Scop., in hayricks on a farm in Fifeshire, *Lochmaea suturalis*, Thoms. [*cf.* **33** 233], which increased in numbers on heather [*Calluna vulgaris*], after having been unimportant since 1938, Tipulids, which injured flax seedlings near St. Andrews, and the mite, *Eriophyes gracilis*, Nal., a heavy infestation of which on raspberry canes on a plantation in Perthshire was associated with stunting.

A wireworm survey, similar to that carried out in England [*cf.* **33** 265] was begun in the east and south-east of Scotland in 1940, and grassland on 70 farms was sampled. Of the fields examined, 70 per cent. had mean populations of less than 300,000 per acre and 47·5 per cent. had less than 100,000, while only 1·5 per cent. had over a million.

FINNEY (D. J.) & JARY (S. G.). **Wireworms and Spring Oats.**—*Agriculture* **52** no. 11 pp. 491–498, 1 pl. London, 1946.

The authors review information obtained in the recent wireworm survey of England and Wales [*cf. R.A.E.*, A **33** 265] with special reference to the loss caused by wireworms to spring oats, which were shown to be one of the most susceptible crops, and describe tests carried out in various parts of the country in 1943 and 1944 of sowing methods designed to produce a denser stand of plants, which might give a satisfactory yield despite attack by wireworms. The tests in 1943 were in fields newly ploughed from old pasture and carrying spring oats as the first arable crop. Part of each field was sown at the farmer's normal seeding rate, and the remainder at a rate about 50 per cent. higher (usually about 4 and 6 bushels per acre, respectively); manuring and other cultivation were uniform over the whole field. In many cases, the larger amount of seed could not be drilled in one operation and was therefore applied by cross-drilling. At about the time of drilling, the fields were sampled for wireworms of the genus *Agriotes* more than 5 mm. long by the standard technique; sample estimates of plant density were made as soon as possible after the seedlings appeared above the ground and again 2–3 weeks later, and the average of the two served as an index of the stand. Estimates of yield were made just before harvest, either visually or by taking grain samples. The results, which are given in tables, indicate that the extra seed increased the number of plants per acre by about 430,000, irrespective of the wireworm population. Most of the fields with less than 600,000 wireworms per acre had a sufficient stand to give a satisfactory yield with normal seeding, but the extra seed was required to give stands of over a million plants per acre in the presence of higher populations. The increase in yield per acre due to it ranged from 1·3 cwt. in fields with less than 300,000 wireworms per acre to 4·8 cwt. in those with more than 1,025,000.

It was observed in some of the tests that the yield was apparently greater in cross-drilled fields than in those drilled one way, and further trials were therefore carried out in 1944. In these, spring oats were the first or second arable crop on old grassland, and half of each field was sown at the farmer's normal seeding rate drilled in one direction, and the other half given the same total amount of seed drilled in two directions. The wireworm populations were estimated somewhat more precisely than before; twice as many samples were

taken and some of these were treated by a flotation method [*cf.* **34** 329] that recovered more of the smaller wireworms. The cross-drilling increased the number of plants per acre by between 140,000 and 300,000, or about half the increase given by the higher seeding rate in 1943, and these increases were not related to the level of wireworm population. The increase in yield ranged from 1·1 to 4·2 cwt. per acre in fields having up to 300,000 and over 1,025,000 wireworms per acre, respectively, as shown by the hand-sorting method, and roughly double these numbers by the flotation method. The authors point out that where visual estimation of yield was employed, the estimates may have been biased in favour of cross-drilling by the more regular spacing of the crop; moreover seed drills set at the lower rates tend to deliver slightly more than the amount intended, so that an appreciably larger total amount of seed may actually be sown in cross-drilling. Consequently the results of these last experiments may appear unduly favourable.

Sims (R. B.). **Observations with a possible Bearing on the Prey of *Chrysopa phyllochroma* Wesm. (Neuropt.).**—*J. Soc. Brit. Ent.* **2** pt. 7 pp. 250–251. Parkstone, Dorset, 1945.

Considerable numbers of adults of *Chrysopa phyllochroma*, Wesm., were observed in fields of sugar-beet in the fenlands of eastern England in June and July 1944, and eggs were present on as many as 20 per cent. of the plants at the end of July. Nearly all of them had hatched by the second week of August. This Chrysopid has been recorded as showing a preference for fields of beans infested by *Aphis fabae*, Scop. (*rumicis*, auct.) [*R.A.E.*, A **12** 285] and may have been attracted to the beet fields by the presence of the latter, which has caused repeated injury to sugar-beet in the fenlands of recent years.

Insect Pests.—*Agric. Gaz. N.S.W.* **56** pt. 12 pp. 549–552, 3 figs. Sydney, 1945.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **34** 71] includes notes on the bionomics of *Aonidiella aurantii*, Mask., on *Citrus* and its control by oil sprays, fumigation with hydrocyanic acid gas or both [*cf.* **34** 289]. Only limited control is afforded by parasites, which include *Aphytis chrysomphali*, Merc., and *Aspidiotiphagus australiensis*, Gir., and by predacious Coccinellids, including *Orcus chalybeus*, Boisd., and *O. australasiae*, Boisd.

In a section (p. 552) by A. H. Friend, it is stated that promising results were obtained in laboratory experiments with aqueous emulsions of solutions of DDT [2,2-bis (parachlorphenyl)-1,1,1-trichlorethane] and gammexane [the γ isomer of benzene hexachloride (**33** 257)] applied to apple foliage against adults of *Baryopadus squalidus*, Boh., whereas sprays of lead arsenate and cryolite were ineffective. The optimum concentrations of DDT were 0·1 and 0·2 per cent. w/v. In experiments on the possibility of killing the newly hatched larvae when they drop to the ground and so preventing damage to the roots of the trees [*cf.* **24** 446], larvae placed on soil mixed with DDT and gammexane (0·5 and 0·2 per cent. w/w) were quickly inactivated.

Adults, eggs and root damage typical of the larvae of this weevil have been found on *Eucalyptus amplifolia*, which thus appears to be a native food-plant.

Holdaway (F. G.) & Look (W. C.). **Studies on the Control of Beet Webworm *Hymenia recurvalis* (Fabricius).**—*Progr. Notes Hawaii agric. Exp. Sta.* no. 41, 10 pp. multigraph., 6 refs. Honolulu, 1944.

An account is given of experiments in Hawaii in 1941 in which proprietary products containing pyrethrins were tested for the control of *Hymenia recurvalis*,

F., on beet, the main results of which have already been noticed [*R.A.E.*, A **32** 137]. In further work with dusts in 1943, the percentage reductions in infestation, as compared with no treatment, were 94·7 for a preparation containing 0·2 per cent. pyrethrins in an unknown diluent, 75·8 and 87·4 for mixtures of nicotine sulphate in lime and talc, respectively, and 86·3 for one of free nicotine and talc. The nicotine content in the last three dusts was 4 per cent.

Durán M. (L.). **Las cuncunas de los pinos, un problema de entomología forestal.** [Pine Caterpillars, a Problem of Forest Entomology.]—*Agricultura téc.* **4** no. 1 pp. 17–25, 6 figs., 11 refs. Santiago, Chile, 1944.

The larvae of the Lasiocampid, *Macromphalia dedecora*; Feisth., and the Saturniid, *Catocephala* (*Dirphia*) *amphinome*, F., which attack many forest and ornamental trees in Chile, have caused serious damage in pine plantations south of Santiago. The outbreaks are periodic and presumably depend on weather, but are favoured by the establishment of unmixed plantations, and organisation on a national scale is required if control is to be adequate. Methods that might be employed are reviewed. In addition to the parasites already noted [*R.A.E.*, A **6** 428; **7** 252], *Apanteles dirphiae*, Silva, *A. camachoi*, Silva, and *Phaesarcodexia edwardsii*, Hall, parasitise the larvae of *C. amphinome*, and *Podisus* (*Apateticus*) *nigrolimbatus*, Spin., is predacious on them.

Pairoa E. (H.). **Estudios sobre un Pentatómido útil, el *Apateticus* (*Podisus*) *nigro-limbatus* Porter.** [Studies on a useful Pentatomid, *Podisus* (*Apateticus*) *nigrolimbatus*, Spin.]—*Agricultura téc.* **4** no. 1 pp. 26–37, 5 figs., 15 refs. Santiago, Chile, 1944.

The author describes the geographical distribution, systematic position and immature stages of *Podisus* (*Apateticus*) *nigrolimbatus*, Spin., a Pentatomid that has been known for some years to be predacious on larvae of *Orgyia* (*Notolophus*) *antiqua*, L., on apple in southern Chile [*cf. R.A.E.*, A **31** 206] and has more recently been observed in various districts there attacking larvae of *Caliroa limacina*, Retz., *Catocephala* (*Dirphia*) sp. and *Macromphalia* sp. [*cf.* preceding abstract] and a nymph of *Schistocerca cancellata*, Serv. Observations on its life-history in the laboratory in Santiago showed that there are three overlapping generations a year. Eggs laid in January, March–April, May and July hatched in 8, 16, 20–22 and 49 days, respectively, and the duration of the nymphal stage ranged from 32–34 days for individuals that hatched in late January to 136–146 for those that did so in mid-April. Adults that emerged in January survived for about a month, and those that emerged in autumn for over three months. Eggs were found in summer in clusters on the lower surface of leaves of apple, pear, raspberry and poplar, and some of those on poplar were parasitised by a Scelionid of the genus *Trissolcus*. The nymphs are at first gregarious, and feed on the tender parts of the plants on which they hatch before developing the predacious habit. They then become very voracious; 35 nymphs 15 days old were observed to destroy more than 200 larvae of *Macromphalia* sp. in two days. The method of attack is described. When no prey is available, the bugs suck the juices of leaves and stems, but they prefer a carnivorous diet, and even attack examples of their own species. In laboratory experiments, they attacked all the insects on which they were observed to feed in nature, and also larvae of *Laora variabilis*, Phil., *Heliothis armigera*, Hb. (*obsoleta*, F.) and *Thanatopsyche chilensis*, Phil.

The author suggests that the Pentatomid should be reared on a large scale in the laboratory and released against Lepidopterous larvae. It could be fed on silkworms [*Bombyx mori*, L.] in the absence of other suitable food.

Olalquiaga Fauré (G.). **Origen y dispersión de algunos Brúquidos del frejol en Chile.** [Origin and Distribution of certain Bean Bruchids in Chile.]—*Agricultura téc.* **4** no. 1 pp. 41–53, 25 refs. Santiago, Chile, 1944.

A campaign was begun in 1939 for the eradication of *Bruchus* (*Acanthoscelides*) *obtectus*, Say, on beans (*Phaseolus*) in the Limache Valley of Chile [*cf. R.A.E.*, A **32** 100, 295 ; **34** 205], and Bridwell has recently described a new American bean Bruchid, *B.* (*A.*) *obreptus*, which the author has reared from cowpea in that country [**32** 100]. He discusses Bridwell's work on the identity of these species, the scanty evidence as to the period for which bean Bruchids may have been present in Chile, and references to Bruchids in Chile in the older literature. Records showing their local distribution on field and stored beans since 1890, which he reviews at some length, include one of a species in stored beans that he considers to be *Spermophagus* (*Zabrotes*) *subfasciatus*, Boh.

Durán M. (L.). **Primer ensayo de importación de insectos benéficos de Europa a Chile.** [A first Attempt to import beneficial Insects from Europe into Chile.]—*Agricultura téc.* **4** no. 1 pp. 57–58, 6 refs. Santiago, Chile, 1944.

A consignment of *Stethorus punctillum*, Weise, a Coccinellid that is predacious on *Tetranychus telarius*, L., was sent by airmail from Berlin to Santiago in late August 1939. The insects arrived in good condition, but died soon after, apparently through lack of food. Recent observations have shown that in Santiago the eggs of *T. telarius* begin to hatch in the first half of September ; future consignments of *S. punctillum* should therefore be made in late September or October, when an abundant food-supply is available.

Durán M. (L.). **Enemigos naturales del gén.** *Pseudococcus* **establecidos en Chile.** [Natural Enemies of the Genus *Pseudococcus* established in Chile.]—*Agricultura téc.* **4** no. 1 p. 102. Santiago, Chile, 1944.

Of the insects that were introduced from California into Chile between 1931 and 1939 for the control of *Pseudococcus* spp. on fruit trees and other plants [*cf. R.A.E.*, A **31** 290], *Coccophagus gurneyi*, Comp., which is effective against *P. gahani*, Green, has become established, and *Leptomastidea abnormis*, Gir., was recovered for the first time in 1942 ; it has since been distributed to other districts in which *P. citri*, Risso, is common. *Cryptolaemus montrouzieri*, Muls., proved effective when released in large numbers, but is not thought to have become established since it has had to be liberated each year. *Leptomastix dactylopii*, How., has not been recovered.

Durán M. (L.). **Une nueva especie de** *Pantomorus* **en Chile.** [A new Species of *Pantomorus* in Chile.]—*Agricultura téc.* **4** no. 1 p. 103. Santiago, Chile, 1944.

Weevils injured grape-vines in Ovalle in October 1942 and attacked several plants, including beans and peach, cherry and orange trees at Linderos in November, and specimens from both places were identified by L. L. Buchanan as *Pantomorus xanthographus*, Germ., a species previously known from Argentina and Uruguay but not from Chile.

Balch (R. E.) & Reeks (W. A.). **Report on Forest Insects in New Brunswick, 1944.**—*108th Rep. Dep. Lds Min. New Brunsw. 1943–44* pp. 108–110. Fredericton, N.B., 1945.

Inspection of balsam fir [*Abies balsamea*] in New Brunswick in June 1944 showed that *Harmologa* (*Archips*) *fumiferana*, Clem., which has recently

increased in parts of Quebec [*cf. R.A.E.*, A **33** 143 ; **34** 173], was present in small numbers throughout the Province, though there was no immediate danger of an outbreak. It was as common on white spruce [*Picea glauca*] as balsam fir. Populations of the spruce sawfly, *Gilpinia hercyniae*, Htg., continued to be fairly low [*cf.* **33** 155], and caused no damage, and the disease of the larvae again gave valuable control. Studies by F. T. Bird indicate that this disease may disappear from areas in which *G. hercyniae* is scarce, but that it can be reintroduced by artifical means [*cf.* **33** 399]. The parasite, *Exenterus* sp., appeared to be maintaining itself despite the reduction in host numbers, and 1,905 examples were liberated in three colonies. Dieback of birch, associated with *Agrilus anxius*, Gory, continued throughout the Province [*cf.* **33** 154]. Light scattered infestations of beech by *Cryptococcus fagi*, Baer., were observed about 35 miles farther north than in the previous year [**33** 155] ; the progress of the infestation was checked by low winter temperatures [*cf.* **33** 354]. The heavy outbreak of *Malacosoma disstria*, Hb., reported in 1943 [**33** 155] spread throughout Madawaska and Victoria Counties and into Maine and Quebec ; pure stands of aspen [*Populus tremuloides*], as well as other hardwoods associated with them, were completely defoliated. *Coleophora laricella*, Hb., which caused extensive browning of larch throughout the whole Maritime Region in 1943, was less numerous in 1944, but defoliation was severe in some districts ; 10,776 examples of *Chrysocharis laricinellae*, Retz., and 475 of *Agathis* (*Bassus*) *pumila*, Ratz., were released against it [*cf.* **33** 155]. The local outbreak of the black-headed fir sawfly, *Neodiprion abietis*, Harr. [recorded on *Abies balsamea* and spruce in 1943 (**33** 155)] began to decrease without causing serious damage. Low winter temperatures prevented *Chermes* (*Adelges*) *piceae*, Ratz. [*cf.* **32** 146] from becoming more numerous on *A. balsamea* ; *Leucopis obscura*, Hal., the predator imported against it [*cf.* **30** 466, etc.], was found to be established over an increased area, but mature trees in infested stands should be promptly felled. *Alsophila pometaria*, Harr., increased locally on elms and spraying was necessary to prevent defoliation. A further liberation of 1,976 examples of the praying mantis [*Mantis religiosa*, L.] was made [*cf.* **33** 155], but no evidence of its establishment was obtained.

Watson (E. B.) & Thompson (R. W.). **Termite Control in Ontario.**—*Process. Publ. Div. Ent. Dep. Agric. Can.* no. 36, [1+] 5 pp., 1 fig. Ottawa, 1945.

In view of damage to buildings in Toronto by *Reticulitermes flavipes*, Koll., late in 1943, 12 years after the last report of subterranean termites in Ontario, the authors briefly describe how these termites and their work can be recognised and give a short account of methods evolved in the United States for controlling them by means of structural improvements and the use of soil poisons.

Thompson (R. W.). **The Status of the European Corn Borer in Ontario in 1944.** —*75th Rep. ent. Soc. Ont. 1944* pp. 6–8. Toronto, 1945.

The percentages of maize stalks infested by the European corn borer [*Pyrausta nubilalis*, Hb.] in the various counties of Ontario in each of the years 1939–44 are shown in a table. Except in one county in which it was the same, infestation was 6–48 per cent. lower in the autumn of 1944 than in 1943 [*cf. R.A.E.*, A **33** 137] in the counties for which figures were available for both years. Unfavourable weather in spring had rendered the disposal of maize refuse difficult, but the total amount not disposed of was less than in 1943. Commercial losses were smaller than in 1943 and involved only very early sweet maize for canning and a little early maize for market. Field maize was not severely infested. Weather conditions in spring had favoured the borer,

but drought during the period when eggs were being laid and the larvae were entering the stalks is thought to have been responsible for a reduction in the numbers of the univoltine strain, which were the smallest recorded since the moth became well established in Ontario. Infestation was distributed more evenly within the fields than in 1943 owing to more uniform planting dates. The two-generation strain [**31** 457 ; **33** 138] was found to be present in seven counties.

HAMMOND (G. H.) **Chloropicrin as a Control for Larvae of** *Phyllophaga*. **A preliminary Report.**—*75th Rep. ent. Soc. Ont. 1944* pp. 8–10, 4 refs. Toronto, 1945.

The author refers to previous work on the use of chlorpicrin as a soil fumigant against Lamellicorn larvae [*R.A.E.*, A **11** 528 ; **18** 614 ; **33** 58], and describes experiments in Ontario in 1944 in which it was tested against larvae of *Lachnosterna* (*Phyllophaga*) *anxia*, Lec., and *L.* (*P.*) *fusca*, Froel. The areas of turf selected were known to contain 55–130 larvae per square yard, and were marked out with frames one yard square ; no covering was employed to prevent the escape of the gas, as all treated plots were sampled 24 hours after injection, which was effected with a soil injector calibrated to discharge 1 cc. per injection at a depth of five inches. The soil was subsequently examined to a depth of ten inches. In the first test, which was carried out on 25th July against second-year, third-instar larvae, complete mortality was obtained with 36 injections per square yard, equivalent to approximately 613 lb. chlorpicrin per acre. In the others, carried out on various dates in August against first-year, second-instar larvae, all larvae were killed by five or more injections per sq. yd. (at least 85 lb. per acre) and 84·9 per cent. by four (68 lb. per acre). The survival of some larvae in the last test is attributed partly to the small number of injections, and partly to a drop in the soil temperature, which delayed the action of the gas. These results indicate that satisfactory control could be obtained at a reasonable cost, and since the injurious second-year larvae occur only every third year in eastern Canada, treatment would be necessary only at intervals of three years. Ants, wireworms and other insects in or on the soil at the time were also effectively controlled. Chlorpicrin is injurious to plants, and at least a week should elapse between its application and seeding or planting out.

SEAMANS (H. L.), MANSON (G. F.) & FARSTAD (C. W.). **The Effect of the Wheat Stem Sawfly** (*Cephus cinctus* **Nort.) on the Heads and Grain of infested Stems.**—*75th Rep. ent. Soc. Ont. 1944* pp. 10–15, 5 refs. Toronto, 1945.

The types of damage to wheat that have been attributed to *Cephus cinctus*, Nort., and *C. pygmaeus*, L., which are similar in habits, are discussed from the literature and in the case of the former, from observations in Alberta. In that Province, the adults of *C. cinctus* emerge from the stubble in the latter part of June or when the spring wheat is beginning to flower ; oviposition begins a day or two later and continues for 2–3 weeks, and the females usually select the best developed stems in which to lay their eggs [*cf. R.A.E.*, A **34** 174]. The larvae hatch in 7–10 days and usually girdle the stems about the end of the first week in August, though they have been observed doing so in July in stems that have dried prematurely.

Injury to the stems by these sawflies has been stated to cause not only lodging, but also white heads (prevention of grain formation), white tips (terminal sterility of the heads) and inferior grain. The amount of loss due to lodging varies considerably according to the stand of wheat, the weather and the type of harvesting equipment [*cf.* **34** 146]. When the weather is good and

improved methods of harvesting are used, most of the fallen stems are recovered and a heavy infestation by *C. cinctus* may cause a loss of only about 5–10 per cent. of the total yield, but when rains have forced the stems to the ground and caused the grains to sprout, losses in Alberta have exceeded 50 per cent. In observations there in 1927 on the reduction in yield due to inferior heads, the number of grains produced by infested stems averaged 27·7, as compared with 30·2 produced by uninfested stems that had apparently been at the same stage of development when the females were ovipositing. In 1928, there was an average of 2·1 more grains per head in 40 heads comprising 669 grain-bearing spikelets from uninfested stems than in the same number of similar heads and grain-bearing spikelets from infested stems. Comparison of the numbers of grains produced in each spikelet on infested and uninfested heads that had the same total number of spikelets and the same number of sterile basal spikelets indicated that infestation had weakened the stems to such an extent that some florets had not produced grain. The presence of 1 and 2 sterile basal spikelets was found to reduce the yield of an uninfested head by 6–10 and about 15 per cent., respectively. When stems that appeared attractive for oviposition were marked in spring, before the adults emerged, and examined at harvest, the average number of grains produced by uninfested and infested stems was found to be 22·4 and 21·7, respectively, and the number of sterile spikelets per head appeared to be about doubled on infested stems. It is estimated from these observations that the crop loss due to *C. cinctus* in an average season would be about 10 per cent. provided that all the stems cut by the larvae are recovered. In addition to this direct loss, infested stems produced grain that was lower in quality than that from uninfested ones and weighed 2 lb. less per bushel [*cf.* **33** 382]. The occurrence of white heads as a direct result of infestation by *C. cinctus* is rare in Alberta, but has occasionally resulted when infestation is associated with other damage [*cf.* **27** 680]. White tips, which are common in Alberta after severe drought or hot winds, are not associated with *C. cinctus*.

GORHAM (R. P.). **The Progress of the Potato Aphid Survey in New Brunswick and adjacent Provinces.**—*75th Rep. ent. Soc. Ont. 1944* pp. 16–22, 15 refs. Toronto, 1945.

The results are given of the survey of Aphids on potato in Quebec, New Brunswick, Nova Scotia and Prince Edward Island in 1942 [*R.A.E.*, A **31** 458], 1943 and 1944, in the last of which years its scope was extended to include Alberta, the Magdalen Islands and parts of Newfoundland, though the numbers of samples from these areas were not large. The species concerned were the same as before; *Macrosiphum solanifolii*, Ashm., and *Myzus persicae*, Sulz., were found in all areas, and *Aphis rhamni*, Boy. (*abbreviata*, Patch) and *Macrosiphum solani*, Kalt. (*Myzus pseudosolani*, Theo.) in all except Alberta. *Macrosiphum solanifolii* was the commonest species in all areas in 1943 and in all except New Brunswick, where *Myzus persicae* was the most prevalent, in 1944. Infestation was mostly light or medium in intensity in all areas, but some cases of severe infestation were observed in New Brunswick, Prince Edward Island, Quebec and Nova Scotia in both years.

Field observations again suggested that the abundance of *Macrosiphum solanifolii* is related to climatic factors that favour the growth of potato in July [**31** 459]. *Myzus persicae*, however, which attacks older leaves, appears to be directly affected by climate. The rapidity with which infestation by this species develops is largely determined by the availability of opportunity for overwintering, either in the egg stage or by breeding in such shelter as a greenhouse or cellar, and its later abundance and the number of alates that migrate in late July or early August are influenced by temperature and rainfall in June

and early July. Flight-trap records showed that migration may take place over considerable distances and at high elevations [*cf.* **34** 319] and is generally in the direction of the prevailing wind, though storms may cause it to follow other directions. Infestation in eastern Quebec and the three Maritime Provinces decreased in 1943, when there was much rain in summer, but drought prevailed in 1944 in the areas of central New Brunswick where winter food-plants are abundant, and a heavy infestation, which spread to the north and east, developed in early spring and summer. No increase occurred in Quebec and Prince Edward Island, where rainfall was normal. Infestation by *Aphis rhamni* is severe only near its winter food-plants, which include one native and two European species of *Rhamnus* [*cf.* **31** 459]. This Aphid feeds on the lower surface of old leaves of potato and is tolerant of changes in temperature and moisture, but the numbers of eggs that are deposited in autumn and hatch in spring vary from year to year, and factors that affect the egg stage are therefore considered to be of importance in determining abundance. Hatching takes place very early in the year, often before the plant buds open, so that the Aphids on hedge plants can be controlled by means of contact sprays ; they can withstand snowfalls. Very large numbers of alates appear in August, and flight-trap catches indicated that they migrate considerable distances. Many eggs failed to hatch in 1943 and 1944 in New Brunswick, and field populations there decreased in both years. *Macrosiphum solani* was taken in small numbers in each year of the survey, and was unusually abundant in the Magdalen Islands and Newfoundland in 1944.

Baker (A. D.) & Perron (J. P.). **Chemical Control Experiments with the Pea Moth,** *Laspeyresia nigricana* **(Steph.) on the Gaspé Coast.**—*75th Rep. ent. Soc. Ont. 1944* pp. 22–33, 11 refs. Toronto, 1945.

In this paper, which is the third of a series [*cf. R.A.E.*, A **33** 141, 145], the results are given in detail of experiments in Quebec in 1938–41 on the control of *Cydia* (*Laspeyresia*) *nigricana*, Steph., on peas by means of insecticides. The plants were treated up to four times during the period between the beginning of oviposition and the entry of the larvae into the pods ; dusts were applied at 25 lb. per acre and sprays at 150 gals., and treatment was carried out from both sides of the row, with special attention to the flowering parts. The results were rather variable. In 1938, a commercial rotenone spray gave better control of pod infestation than a commercial rotenone dust, a dust of calcium arsenate in Bordeaux mixture or a dust of sulphur and flour, which were effective in that order, and a spray of Paris green was ineffective. The rotenone spray again gave fair results in 1939, but a commercial mixture of nicotine and oil emulsion was better. The best results in 1940 were given by a dust of derris in talc (1 : 5) and the spray of nicotine in oil emulsion (73·7 and 65·5 per cent. reduction in infestation, respectively). A dust of lead arsenate in Bordeaux mixture gave fair control. The materials tested in 1941 were all applied as sprays in 5 gals. water with a commercial spreader and comprised 1·6 oz. lead arsenate, 1 oz. nicotine sulphate, 2·56 oz. derris (5 per cent. rotenone) and 5 oz. commercial oil emulsion, separately or in various combinations. Four applications were made, the first on 21st July, when the pods were beginning to form and the first egg had been observed, and the last on 13th August. The percentages of pods infested averaged 1·58 for derris, nicotine sulphate and oil emulsion, 2·25 for nicotine sulphate and oil emulsion, 2·33 for nicotine sulphate, lead arsenate and oil emulsion, 3·16 for lead arsenate and oil emulsion, 4 for oil emulsion alone, 4·16 for lead arsenate alone, 4·41 for derris and nicotine sulphate, 4·58 for nicotine sulphate and lead arsenate, 6·74 for nicotine sulphate alone and 7·5 for derris alone, as compared with 8·44 for no treatment.

Gregory (F. W.) & Featherston (R. V.). **Hot Water Treatment, under Field Conditions, of Peach Pits infested with Raisin Moth.**—*75th Rep. ent. Soc. Ont. 1944* pp. 34–35. Toronto, 1945.

In October 1943, 200 bags containing 5 tons of peach stones imported from California into the Niagara Peninsula of Ontario for propagation purposes were found to be heavily infested by larvae of *Ephestia figulilella*, Gregson [*cf. R.A.E.*, *A* **23** 19]. Large numbers were found in the loose peach flesh adhering to the stones, and some within the kernels and along the seams of the jute bags. As *E. figulilella* does not occur in the district, the entire consignment was dipped at the end of October in hot water in a small tank so constructed that a fire could be built directly under it. Each bag was submerged for 6–10 seconds in water at a temperature of 123–128°F., and then placed upright for drying and examination. The stones appeared much brighter, with very little peach flesh adhering, and the infestation was reduced to only 2–3 living larvae per bag. Several living larvae were collected immediately after treatment, and kept for observation ; 40 per cent. of them were still alive and active after about a week. The peach stones were planted almost immediately and gave rise to seedlings that appeared in the following summer to be superior to others, so that the treatment may actually have hastened germination and growth.

Twinn (C. R.). **A Summary of Insect Conditions of Importance or special Interest in Canada in 1944.**—*75th Rep. ent. Soc. Ont. 1944* pp. 45–49. Toronto, 1945.

In addition to many pests of common occurrence in Canada, the insects recorded include the bertha armyworm [*Barathra configurata*, Wlk.], an outbreak of which occurred, for the first time in 15 years [*cf. R.A.E.*, A **16** 508 ; **18** 117], in various districts of Saskatchewan, flax being the principal crop attacked. The flax bollworm, *Heliothis ononis*, Schiff., caused an average loss of 3 per cent. on flax in west-central and south-western Saskatchewan [*cf.* **33** 143]. Serious damage to potato by *Epitrix tuberis*, Gentner, had occurred in three districts in British Columbia in 1943 and was more widespread there in 1944. Apparently for the first time, very light infestations of a mealybug on apple, believed to be *Phenacoccus aceris*, Sign., were found in orchards in New Brunswick, and this species was also reported for the first time in the Victoria district, British Columbia.

Pepper (B. B.). **The Mexican Bean Beetle.**—*Circ. N. J. agric. Exp. Sta.* no. 495, 12 pp., 7 figs., 1 ref. New Brunswick, N. J., 1945.

In this circular, which is a revision of one already noticed [*R.A.E.*, A **18** 116], it is stated that there are three generations of *Epilachna varivestis*, Muls., per year on beans throughout New Jersey. Of the insecticides recommended, derris or cubé, applied in sprays or dusts [*cf.* **25** 318–319] are considered the best.

Cottier (W.). **The Use of Lead Arsenate as a Control for the Grass-grub, *Odontria zealandica* White.**—*N.Z. J. Sci. Tech.* **27** (A) no. 3 pp. 239–243 4 refs. Wellington, N.Z., 1946.

The following is largely based on the author's summary of the results of further investigations on the value of acid lead arsenate powder as a soil dressing against the larvae of *Odontria zealandica*, White, in New Zealand

[*cf. R.A.E.*, A **20** 557]. Surface dressings of lead arsenate mixed with sand or fine earth (1 : 2) were applied in April to infested turf at the rate of 2½, 5, 10 and 20 lb. lead arsenate per 1,000 sq. ft. ; 4–5 weeks later the population of grubs already present at the time of treatment was unaffected in all plots, but after 18 weeks the two higher dosages had caused significant reductions. In subsequent experiments, in which lead arsenate at the rate of 2½, 5 and 10 lb. per 1,000 sq. ft. was applied in April to heavily infested turf, significant reductions were observed in all plots after 24 weeks, and all three treatments very greatly reduced re-infestation of the turf in the following season. Vigorously growing turf showed no permanent injury after treatment with 10 lb. lead arsenate per 1,000 sq. ft. ; turf that was less vigorous was sometimes severely injured by this dosage, but only very weak turf was injured by 5 lb. A top-dressing of ammonium sulphate (2 cwt. per acre) assisted grass to recover from the injury. Preliminary tests over a period of ten months indicated that dressings of sodium nitrate or ammonium sulphate at rates of ½, 1 and 2 cwt. per acre, or superphosphate at 2, 3 and 4 cwt. per acre, did not impair the efficiency of lead arsenate worked into the soil to a depth of 2 inches at a dosage equivalent to 2 lb. per 100 sq. ft. [*cf.* **21** 456 ; **26** 324].

When strips of soil 6 ins. wide in an area that had been infested each season for some years were treated in June with lead arsenate at the rate of 1 lb. per 100 linear ft., which was then worked into the top 2 3 ins. of soil, and strawberries were planted in the strips, no infestation occurred for three seasons, when the observations were concluded. The dressing caused no injury to the plants.

Cottier (W.) & Jacks (H.). **The Effects of Rotenone-bearing Dusts on the Diamond-back Moth** (*Plutella maculipennis* **Curt.**).—*N.Z. J. Sci. Tech.* **27** (A) no. 3 pp. 244–249, 17 refs. Wellington, N.Z., 1946.

Since a review of the literature and the authors' own observations indicated that the toxicity of rotenone-bearing materials cannot always be assessed by their yield of rotenone or ether extract, experiments were carried out in New Zealand to compare the value in dusts against *Plutella maculipennis*, Curt., on cabbage of three samples of powdered derris root containing 2·7, 2·9 and 3·4 per cent. rotenone and 13·6, 13·7 and 18·6 per cent. ether extractives, respectively, and one of cubé root containing 3·5 and 20·5 per cent. They were diluted with kaolin, or with siliceous earth in the case of one sample of derris, to give rotenone contents of 0·25, 0·5, 0·75 and 1·0 per cent. Six applications of each dust were made between 12th February and 1st April to plots of cabbage at the rate of 25 lb. per acre, and the two lower concentrations were also applied at 50 lb. per acre. The yields of marketable heads obtained in mid-April from treated plots, which are given in tables, showed that increasing the concentration of rotenone increased the effectiveness of dusts made up from the same sample of root, but dusts of the same rotenone content from different roots differed considerably in effectiveness. These differences were not attributable to differences in the content of ether extractives or to any important variation in the diluent or in the size of the rotenone-bearing particles [*cf. R.A.E.*, A **32** 367], and it is concluded that the varying performances of the dusts are best explained as the result of active ingredients other than rotenone [*cf.* **29** 29 ; **30** 500].

The control given by 0·25 and 0·5 per cent. rotenone at 50 lb. per acre was inferior to that of 0·5 and 1 per cent., respectively, at 25 lb. per acre.

The Borolia Caterpillar of Paddy (*Borolia venalba*).—*Leafl. Dep. Agric. Ceylon* no. 155, 1 p., 1 pl. Peradeniya, 1939.

A brief account is given of the bionomics of *Borolia venalba*, Moore, on rice in Ceylon. Larvae of this Noctuid are sometimes present in small numbers during

outbreaks of the paddy swarming caterpillar [*Spodoptera mauritia*, Boisd.], and occasionally occur alone and cause extensive damage, especially in the Kandy district and in parts of the Southern Province. The females begin to oviposit 3–6 days after emergence, and lay 300–900 eggs in irregular masses on rice and wild grasses. The larvae hatch in 5–6 days, feed for about four weeks and then pupate in cocoons on the food-plants. The pupal stage lasts about a fortnight. Outbreaks are usually controlled by parasitic Hymenoptera and Diptera. Artificial measures recommended, which are also useful against *S. mauritia*, comprise the removal of weeds and wild grasses, the flooding and oiling of rice-fields, and the encouragement of birds.

SESHAGIRI RAO (D.). **A Note on the Jola Grasshopper (*Colemania sphenarioides*, Bol.) and its Control during the Years 1941 and 1942.**—*Mysore agric. J.* **22** no. 1 pp. 9–12, 2 refs. Bangalore, 1943.

The outbreak of *Colemania sphenarioides*, Bol., that occurred in Mysore in 1941 and 1942 was more restricted and milder than any of those previously recorded [*cf. R.A.E.*, A **34** 207], possibly because poor and delayed rainfall resulted in desiccation of the eggs in the soil or because 1943 was actually to be the first year of severe incidence in this cycle. It was found that the various types of soil in the infested areas are all equally liable to infestation, and that ridges are more often infested than low-lying fields. Hatching occurred chiefly on the grass strips between fields, except in a few badly ploughed fields that contained unbroken clods, and the hoppers did not move from the grass to the crops for about a month. They were most abundant in patches of luxuriant growth.

Cultural control measures in use comprise alternating sorghum with cotton and ground-nuts, which are not materially damaged by the grasshoppers, and sowing it more thinly than usual, since attack is more intense on denser growth. A dust of sodium fluosilicate in rice bran (1 : 3) applied to badly infested grass strips through a thin cloth or a finely perforated tin gave 70–80 per cent. reduction in the hopper population 48–72 hours after treatment, though only small numbers of dead hoppers were found. Ants were observed carrying some away, but could not have accounted for the almost complete absence of dead insects, and it is possible that mass migration from the dusted areas may have occurred. Certain areas that were dusted in 1941 were relatively free from infestation in 1942. Rain within two days of treatment washed away the dusts. A bait of sodium fluosilicate and rice bran (1 : 9 or 1 : 5) with a little salt and water to moisten it gave a considerable reduction of hoppers in three days when spread thinly over heavily infested sorghum fields, but scorched the plants slightly. The efficiency of the bullock-drawn trap used for control [*cf.* **21** 152] was increased by replacing the bag by a zinc tank filled with water on which was a film of oil, but a smaller trap consisting of a trailing bag suspended from a triangular frame with a curved sloping roof, mounted on wheels and pushed by one man, was relatively more effective, especially on a low crop.

KRISHNAMURTI (B.). **Some simple Means of keeping Food Grains in Storage free from Insect Infestation and Damage.**—*Mysore agric. J.* **22** no. 2 pp. 40–45, 1 fig. Bangalore, 1943.

Stored grains in Mysore are attacked by numerous insects, of which the commonest are *Corcyra cephalonica*, Staint., and *Calandra oryzae*, L., in rice, *Sitotroga cerealella*, Ol., in unhusked rice (paddy), *Rhizopertha dominica*, F.

and *Alphitobius* sp. in ragi [*Eleusine coracana*], *C. oryzae*, *R. dominica*, *Trogoderma granarium*, Everts, and *S. cerealella* in wheat, *C. oryzae*, *Corcyra cephalonica*, and *Tribolium* spp. in sorghum, and Bruchids, notably *Bruchus chinensis*, L., in pulses. Uninfested grain that is to be kept for not more than 6–8 weeks should be stored in clean airy warehouses in such a way that it is not in direct contact with the floor or walls and has plenty of space between the rows if it is in bags. Spraying with a petrol or kerosene extract of pyrethrum so as to produce a fine mist all over the interior of the warehouse should be carried out every evening. Badly infested grain should be segregated and fumigated for 48 hours with 1 pint pure petrol (unleaded) per 25 cu. ft. space and then aired thoroughly for 24–48 hours. Grain that is to be kept for long should be thoroughly dried in the sun and stored in a bin with a wide neck, into which is fitted a plate of wood or metal on which is a layer of sand. Sliding doors at the bottom of the bin allow the grain to be removed as required. Mills should be sprayed frequently and the usual sanitation measures adopted in them.

[Krishnamurti] Krishnamurthy (B.) & Seshagiri Rao (D.). **A brief Review of the Methods adopted in rural Parts and the Experiments and Observations made in India, in the Matter of Storage of Food Grains.**—*Mysore agric. J.* **22** no. 3 pp. 65–74, 4 refs. Bangalore, 1944.

The authors describe ways of treating grain before storing it and methods of storage used in country districts in Mysore, and give the results of experiments and observations on their value in preventing infestation by insects. It was found that wheat and parboiled rice stored in gunny bags or earthen pots were liable to considerable damage by insects and that plastering the covers of earthen pots with mud did not protect the contents. When wheat was dried in the sun for three days before storage in stoppered jars, examination every six months for three years showed that the grain was not attacked and that weevils [*Calandra oryzae*, L.], introduced before storing it and after every inspection, were dead. This grain did not germinate when tested at the end of six months unless the jars had been opened occasionally to allow it to absorb moisture from the atmosphere. Grain containing more than about 8 per cent. moisture was susceptible to attack. Larvae of *Trogoderma granarium*, Everts (*khapra*, Arr.), were killed in the Punjab by exposure to temperatures of 50–51°C. [122–123·8°F.] for five hours or 85–100°C. [185–212°F.] for 30 seconds. Mixing powdered lime, sand, leaves of *Vitex negundo* or neem [*Melia azadirachta*], ashes, road dust or rice husks with the grain gave little or no protection; smearing with vegetable oils was of some value and protected pulses from Bruchid attack by causing faulty adherence of the eggs, but reduced germination. Storing the grain with small quantities of camphor, asafoetida, sulphur or naphthalene gave only temporary control. The presence of a pellet of mercury in the shell of a soapnut prevented hatching in small jars and reduced it by 75 per cent. in larger containers. Covering the grain with a layer of fine sand 2–4 ins. deep, placed either directly on it or over a cloth or other covering, gave complete protection for long periods [*cf. R.A.E.*, A **26** 204].

[Krishnamurti] Krishnamurthy (B.) & Seshagiri Rao (D.). **Results of certain Experiments and Observations carried out recently in the Matter of Control of Insect Pests of Food Grains in Storage.**—*Mysore agric. J.* **22** no. 3 pp. 91–101, 3 refs. Bangalore, 1944.

Krishnamurti (B.) & Seshagiri Rao (D.). **Results of a further Series of Experiments and Observations on the Control of Insect Pests of Food Grains in Storage.**—*T.c.* no. 4 pp. 122–127.

In the first of these papers are described experiments in Mysore in 1944 on the value of mixing various insecticidal and inert substances with cereals and

pulses for the control of *Calandra oryzae*, L., and Bruchids, respectively. Road dust sieved through a double layer of fine cloth was ineffective, presumably because the individual particles were not fine enough to adhere to the grains. Finely ground wood ash, lime and kaolin appeared to have a certain deterrent effect, and the last caused some mortality of weevils and Bruchids. Coal ash ground to a fineness of 4–15 microns and mixed with the grain at the rate of 1 per cent. by weight, appeared an effective deterrent and killed most of the adult weevils and Bruchids present in three days. Finely ground rice-husk ash (4·5–13·5 microns) used at the same rate against Bruchids gave similar mortality [*cf. R.A.E.*, A **32** 389]. Coarse burnt rice husk and raw husk (powdered or otherwise) were less effective.

Ground derris root and pyrethrum powder mixed with the grain at the rate of 2 or 3 per cent. did not adhere well to it, but were fairly effective as deterrents and insecticides; the powdered bark of *Mundulea* stems, which was nearly six years old, was rather less effective. Copper carbonate (1 per cent.) adhered well to the grain and was about as effective as coal ash, and sodium fluosilicate (2 per cent.) adhered well, but appeared to act rather slowly. Free mercury proved ineffective against adult insects and larvae. All the materials tested were readily removed from the grain by washing with water.

Spraying with a petrol or kerosene extract of pyrethrum in storage premises gave high mortality of adults of *Corcyra cephalonica*, Staint., *Sitotroga cerealella*, Ol., and *Bruchus chinensis*, L., but was less effective against those of *Tribolium*, *Rhizopertha dominica*, F., and *Calandra oryzae*. *C. oryzae* was more readily killed in damaged stocks of sorghum than in sound grain. Adults of this weevil that were confined in batches of 100 on the outside of bamboo bins coated with paper mash and vegetable mucilage, alone or mixed with coal-tar emulsion (50 per cent.) or asafoetida, or with a mixture of cowdung, red earth and a paste of the leaves of *Vitex* [*negundo*], neem [*Melia azadirachta*] or custard apple [*Annona*] made no attempt to bore through to the grain inside, but two holes were bored by those caged on a bin coated with cowdung and red earth alone.

Further tests of the same inert and insecticidal dusts mixed with stored cereals against *C. oryzae* are described in the second paper. They confirmed those recorded in the first, and showed that the finely ground rice-husk ash has a high deterrent and insecticidal effect against the weevil. A test with *Rhizopertha dominica* and *Tribolium* sp. indicated that the order of efficiency of the dusts against them is the same as against *C. oryzae*, but that they are rather more resistant than the latter.

HUSTACHE (A.). **Nouveau Curculionide tropical introduit en France.**—*Echange* **57** no. 484 p. 6. Moulins, 1941.

Ovanius cattleyae, sp. n., is described from two adults taken in an orchid house in Normandy in 1921 on blossoms of *Cattleya* sp. It must have been introduced from tropical America, where orchids of this genus are indigenous.

BRUNER (S. C.), SCARAMUZZA (L. C.) & OTERO (A. R.). **Catálogo de los insectos que atacan a las plantas económicas de Cuba.** [A Catalogue of the Insects that attack economic Plants in Cuba.]—*Bol. Estac. exp. agron. Cuba* no. 63, [3+] 246 pp., 12 pls. Havana, 1945.

Lists, arranged under the plants attacked, are given of the insects, mites and a few other pests that injure economic plants in Cuba. Those of greater importance are distinguished from others, and notes are given in some cases on habits and distribution, with lists of parasites and predators. A systematic list of the pests included, with references to the pages on which they occur in the main list, an index to the natural enemies and another to the popular names of the plants are appended.

Rodríguez Lz. (L.). **Una plaga de los eucaliptos.** [A Pest of *Eucalyptus*.]—*Bol. Inst. bot. Univ. Ecuador* 1945 no. 5 pp. 117–122, 1 pl. Quito, 1945.

Eucalyptus trees in the Province of Cotopaxi, Ecuador, were recently found to have been weakened or killed by larvae of the Cerambycid, *Paramallocera ilinizae*, Kirsch. The stand most seriously injured was surrounded by numerous old capulí trees (*Prunus capollin*), which were also infested and most of which had died long since. As the capulí is of earlier cultivation than *Eucalyptus*, it probably served as the source of the infestation. The larvae were also found attacking peach, pear, apple and greengage and felled timber. Little is known of the bionomics of this beetle, of which all stages are briefly described. Observations have shown that the eggs are laid in the bark and covered with a viscous fluid. The larvae hatch in 3–4 weeks and bore in the cambium layer for a year or more. The tunnels made by them are of very varying lengths, and may extend upwards or downwards ; some go down to the ground. The larvae pupate in shallow cells in the woody tissue, and the emergence holes of the adults, which are about 1 cm. in diameter, are readily visible on smooth-barked trees. The pupal stage lasted 29 days in the laboratory at 20°C. [68°F.]. The adults are nocturnal, usually remaining hidden and inactive by day.

The destruction of the cambium layer causes branches to die off above the site of the attack, and if the trunk is girdled the whole tree dies. Control by chemical means is impracticable, but to prevent the spread of the beetle, the zones in which *Eucalyptus* and other susceptible trees are cultivated were placed under quarantine in May 1943. Instructions were given to fell affected trees, strip off and burn the bark, and pass a flame over the surface of the trunk before the latter was utilised.

Ballou (C. H.). **Notas sobre insectos dañinos observados en Venezuela 1938–1943. . .** [Notes on harmful Insects observed in Venezuela 1938–1943. . .]—*Cuad. verde Com. organ. 3a. Conf. interamer. Agric.* no. 34, 151 pp., 6 pls. Caracas, 1945.

This work, which is based on observations in Venezuela between March 1938 and December 1943, is divided into two parts. The first consists chiefly of an alphabetical list of cultivated plants, arranged under their popular and scientific names, with records of the insects observed attacking them, the date and locality of the observation, and in some cases the part attacked, the stage responsible and the extent of the damage. A few mites are included. This part also contains similar lists of household pests, pests of stored products and Arthropods that are injurious to man, domestic animals and honey bees. In the second part, the same records are arranged under the pests concerned. The author points out in his introduction that of the 298 species mentioned, 67 are unidentified, 75 identified as to genus only and 12 identified only tentatively. An index to the pests is appended.

Marchionatto (J. B.). **Nota sobre la " muscardina verde " (*Metarrhizium anisopliae* (Metch.) Sor.).** [A Note on the green Muscardine Fungus, *M. anisopliae*.]—*Rev. chil. Hist. nat.* **46–47** pp. 12–14, 1 fig. Santiago, Chile, 1944.

The author refers to his earlier work on entomogenous fungi in Argentina [*R.A.E.*, A **23** 12] and states that *Metarrhizium anisopliae* was obtained there from examples of *Schistocerca paranensis*, Burm., from an insectary in 1937 and from Noctuid larvae in 1939, an adult of *Scapteriscus borelli*, G.-T., in 1940, and pupae of *Diloboderus abderus*, Sturm, in 1941, all collected in the field.

Pairoa Epple (H.). **Observaciones sobre la biología del "gusano de los penachos"** *Notholophus* (*Orgyia*) *antiqua* **L. en Chile.** [Observations on the Biology of the Tussock Moth, *Orgyia antiqua*, in Chile.]—*Rev. chil. Hist. nat.* **46–47** pp. 133–140, 5 figs., 3 refs. Santiago, Chile, 1944.

The larvae of the Lymantriid, *Orgyia* (*Notolophus*) *antiqua*, L., feed on the leaves of apple, causing serious damage, in the region between Chillán and Puerto Montt, Chile. Observations on its bionomics showed that it has one and a partial second generation a year. Hatching of the overwintered eggs began in mid-August, reached a peak in late September and was completed by the end of October. Larvae that hatch early are sometimes killed by bad weather. The process of larval development and the colour variations observed in the laboratory in Santiago are described. Of the larvae under observation, 62 per cent. gave rise to males, and these passed through only four instars in 28–31 days before pupating. Of the females, 57 per cent. passed through four instars and the remainder five, in 31–37 and 38–43 days, respectively. These periods were found to be sometimes nearly twice as long in the field in Osorno. Pupation took place in cocoons, on the lower surface of the leaves or in cracks in the bark or on twigs, and the pupal stage lasted 14–15 days for males and 8–13 for females. The females are wingless, and are fertilised and oviposit on their cocoons. Clusters of 220–385 eggs were observed in the field, while females in rearing cages laid 198–313. The eggs on leaf-borne cocoons began to hatch in 15–17 days, all the eggs in a cluster hatching within a few days, but those on cocoons in more permanent sites did not do so until the following spring. *O. antiqua* is parasitised in Chile by the Braconid, *Apanteles riverae*, Porter, and the Torymid, *Perissocentrus porteri*, Brèth., and two Pentatomids [*R.A.E.*, A **17** 23 ; **31** 306] are predacious on it.

Bosq (J. M.). **Un predator de importancia que frecuentemente se olvida, *Coccinella ancoralis* Germ. (Col. Coccinellidae).** [An important Predator which is frequently overlooked.]—*Rev. chil. Hist. nat.* **46–47** pp. 142–144. Santiago, Chile, 1944.

Coccinella ancoralis, Germ., is abundant in all parts of Argentina at various times of the year, and also occurs in Brazil, Chile, Bolivia, Uruguay and Paraguay. The larvae and adults feed on Aphids, of which they destroy large numbers, and occasionally on immature Coccids. They have been observed feeding on *Aphis gossypii*, Glov., on cotton and melon in Santiago del Estero, and on *Toxoptera graminum*, Rond., on cereals in Tucumán [*cf. R.A.E.*, A **29** 36], and are considered by the author to afford considerable control of the latter. The adults fly in swarms from place to place and the author has observed large numbers of them at various times of the year sheltering together in natural refuges, probably preparatory to migration.

Liebermann (J.). **Sobre la importancia económica de las especies chilenas del género *Dichroplus* Stål (Orth. Acrid. Cyrtacanth.), con algunas consideraciones acerca de su biogeografía.** [On the economic Importance of the Chilean Species of the Genus *Dichroplus*, with some Observations on their Biology and Distribution.]—*Rev. chil. Hist. nat.* **46–47** pp. 241–247, 10 refs. Santiago, Chile, 1944. **Los Acridoideos de Chile.**—*Op. cit.* **48** pp. 161–316, 25 figs., refs. 1945.

In the first of these papers, the author states that Acridids of the genus *Dichroplus* are injurious in Chile to maize, hemp, grape vines, garden plants and fodder crops, including lucerne and clover, and gives notes on the local distribution of the five species concerned, with a key to them. They are *Dichroplus*

maculipennis, Blanch., *D. vittiger*, Blanch., *D. porteri*, Lieb., *D. democraticus*, Blanch., and a form of *D. elongatus*, G.-T., to which a subspecific name is given though it is not described. At the time of his visits to Chile in 1942 and 1943, a serious outbreak of *D. maculipennis* was in progress in the Putaendo Valley. Almost the whole of the cultivated land was infested, and damage was intense. The outbreak was stated to have begun about 1933. The grasshoppers were being destroyed by birds, and up to 20 per cent. were parasitised in February 1943 by Sarcophagids.

In the second paper, the author discusses the general value of the study of Acridoidea and reviews the work that has been done on them in Chile, where their economic importance has not been fully appreciated. He then discusses the geographical division of Chile into various natural regions, the ecology of the Chilean Acridoidea, including his own observations made in 1942–43, and their classification, and gives a systematic list of them, with notes on synonymy, morphology, distribution and bionomics. Some 55 species are involved, and the most important is *Dichroplus maculipennis*. The morphology of the females of *D. elongatus* is stated to be so variable that the erection of subspecies is not justified.

ROSENBERG (G.). **El DDT y sus posibilidades en el control de la** *Carpocapsa pomonella*. [The Possibilities of DDT for the Control of *Cydia pomonella*.]—*Agricultura téc.* **5** no. 1 pp. 65–69, 2 refs. Santiago, Chile, 1945. (With a Summary in English.)

Cydia (*Carpocapsa*) *pomonella*, L., is a serious pest of apples and also attacks pears, quinces and walnuts in Chile. Control by lead-arsenate sprays is unsatisfactory owing to the large number of applications required, and small-scale field tests with DDT were therefore carried out on apple in the season of 1944–45. The sprays used consisted of a 4 per cent. solution of DDT in kerosene emulsified in water to give a final DDT content of 0·1 per cent., and Gesarol (which contains 5 per cent. DDT and an adjuvant to facilitate its suspension in water) diluted to give the same final concentration of DDT. Four applications were made at intervals of a month, beginning on 14th October, when the calyx spray of lead arsenate would have been applied. At the time of the second application, the trees were observed to be free from leafhoppers, which were attacking the untreated controls and neighbouring trees sprayed with lead arsenate. Immediately after the third application, on 15th January, counts showed that the percentages of fruits that had fallen and the percentages of these that were damaged by the larvae were 8·1 and 21·4 for the emulsion, 19·6 and 12·2 for the Gesarol, and 61·4 and 92·3 for no treatment, respectively. The apples were picked on 7th March, and the percentages infested and superficially injured were 9·1 and 24·9 for the emulsion, 45·7 and 40·5 for the Gesarol, 10·6 and 27·1 for six applications of lead arsenate at intervals of three weeks, at 4 lb. per 100 gals. in the first and 3·5 lb. in the others and with 1·5 per cent. summer oil in the second and third, and 90·4 and 1·4 for no treatment. The poor results obtained with the Gesarol may have been due to the adjuvant allowing it to be washed off by rain, of which 3·5 ins. fell during the period of the tests.

There was no sign of scorching on the foliage of the trees sprayed with the DDT insecticides.

ROSENBERG (G.) **Nota sobre el envío de un parásito de la polilla de la papa a California.** [Note on the Despatch of a Parasite of the Potato Moth to California.]—*Agricultura téc.* **5** no. 1 pp. 97–98. Santiago, Chile, 1945.

During the rearing of the potato moth, *Gnorimoschema operculella*, Zell., in the laboratory in Chile to provide hosts for *Chelonus phthorimaeae*, Gah., and *Bracon* (*Microbracon*) *gelechiae*, Ashm., which had been introduced from

California, several of the larvae were found to be parasitised by *Copidosoma koehleri*, Blanch. This Encyrtid is polyembryonic, and the author considers that it may be responsible for the fact that *G. operculella* is not a serious pest in Chile.

On 24th March 1945, eight larvae parasitised by *C. koehleri* were sent by air to the substation of the Imperial Parasite Service, in charge of W. F. Sellers, at Riverside, California. They arrived on 31st March ; by this date, 105 adult parasites had emerged, of which 27 were dead. Sellers reported that the remainder, which were in excellent condition, were placed in groups up to ten in test tubes and fed. On 2nd April, 370 eggs of *G. operculella* were exposed to them and reproduction occurred in all the tubes. By 3rd April, a further 25 adult females of *Copidosoma* had emerged ; about 800 eggs were exposed to them and oviposition occurred. Stocks were to be maintained for distribution to interested countries. A request had been received from Australia for a consignment during the next season, and another for material for rearing on a large scale with a view to liberations against *G. operculella* in the south of California and possibly in other parts of the United States.

Durán M. (L.). **Otro enemigo natural de la** *Saissetia oleae* **(Bern.) nuevo para Chile.** [Another new Natural Enemy of *S. oleae* in Chile.]—*Agricultura téc.* **5** no. 1 pp. 98–99. Santiago, Chile, 1945.

In the course of work on the establishment of colonies of *Metaphycus lounsburyi*, How., for the control of *Saissetia oleae*, Bern., on olive in Chile, using material from the Azapa Valley [*cf. R.A.E.*, A **34** 206], *M. helvolus*, Comp., was found in January 1945, parasitising one batch of immature Coccids. This Encyrtid is considered in California to be the most effective parasite of *S. oleae*, and an unsuccessful attempt had been made to introduce it into Chile in 1943. The fact that it parasitises the immature Coccids enables it to survive the winter in districts in which *M. lounsburyi*, which parasitises the gravid females, cannot do so [*cf. loc. cit.*]. *M. helvolus*, like *M. lounsburyi*, is thought to have entered Chile from Peru and to have reached the latter country in a consignment of *M. lounsburyi* sent there from California in December 1936 [*cf.* **25** 614]. This would account for the success obtained in controlling *S. oleae* both in Peru and in the Azapa Valley, which had been mainly attributed to *M. lounsburyi*. The work of establishing new colonies of *M. helvolus* has already begun.

Rovira V. (F.) **La filoxera en los viñedos de Chincha.** [*Phylloxera* in the Vineyards of Chincha.]—*Inform. agric.* **3** no. 11 pp. 4–6, 1 fig. Lima, 1945.

Phylloxera vitifoliae, Fitch (*vastatrix*, Planch.) was found to be abundant and widely distributed on the leaves, shoots and roots of vines in the district of Chincha, Peru, in 1944. It had already been found there in 1905, but had not been noticed since, and no serious economic damage was experienced until about 1941, when the vines began to lose condition and many well-grown and carefully cultivated plants died. The outbreak is attributed to the recent introduction of spring irrigation, the soil humidity combined with a warm atmosphere favouring the development of the Aphid.

The Department of Viticulture recommended the use of irrigation by a system of puddles during the summer, so that the roots are flooded, when a plentiful supply of water coincides with the peak of infestation by *Phylloxera*, and also the application of nitrogenous manures (island guano) to re-invigorate the plants. The only effective means of rehabilitating an infested vineyard is to replant it with resistant stocks of American origin on which the appropriate

wine-producing varieties can be grafted. The resistant variety, Rupestris St. George, is already grown in this region, having been imported from California in 1917, and is considered a suitable stock for the wine-producing varieties normally grown there.

PURCALLAS SALVÁ (P.). **El espectro de la filoxera.** [The Menace of *Phylloxera*.]—*Tierra* no. 1 pp. 19–20, 57, 1 fig. Mexico, D.F., 1945.

The author states that *Phylloxera* [*vitifoliae*, Fitch] is now present on grape vines in Mexico, having been observed by him at Pabellón Aguascalientes, Coahuila, in 1943. He recommends soil fumigation with carbon bisulphide or potassium sulphocarbonate as a means of control where small areas are involved, but considers that the only effective measure against extensive losses is the grafting of the susceptible European vines on to resistant American stocks. A list is given of some resistant stocks suitable to Mexican conditions.

PINKUS (R.). **El injerto de la chinchona.** [Grafting of *Cinchona*.]—*Rev. agríc.* (2) **1** nos. 2–3 pp. 52–55, 135–140, 10 figs. Guatemala, 1944–45.

At the conclusion of this paper on the technique of grafting *Cinchona* on the west coast of Guatemala, it is stated that the only insect that is sufficiently injurious in the plant beds to merit control measures is a Mirid that has been identified as *Poecilocapsus ornatus* [*sic* ? *ornatulus*, Stål]. Nymphs and adults have been observed sucking the juices of the young leaves, and the holes that they pierce become enlarged as the leaves grow, giving them a perforated appearance. This Mirid is indigenous and feeds on many plants; the damage to *Cinchona* occurs chiefly in April and May, and again in August and September. The only method of control employed has been hand-collection early in the morning, which has considerably reduced the injury.

Insect Pest Control.—*Rep. Dep. Sci. Agric. Barbados 1944–45* pp. 14–15. Barbados [1945].

During the year ending 31st March 1945, control of *Diatraea saccharalis*, F., on sugar-cane in Barbados was maintained by the liberation of the egg-parasite, *Trichogramma minutum*, Ril. [*cf. R.A.E.*, A **34** 159] of which 325½ millions were reared and nearly 285 millions released; random sampling showed an average of 11·4 per cent. infested internodes. Factory examination of ripe cane revealed an increase in damage by the weevil, *Metamasius sericeus*, Ol., and the termite, *Eutermes* (*Nasutitermes*) *costalis*, Hlmgr., and field observations showed that both were breeding in cane refuse left in the fields after harvest. Injury to the cane crop by *Diaprepes abbreviatus*, L., and *Clemora* (*Lachnosterna*) *smithi*, Arr., continued to increase, and young ratoons in some areas showed a noticeable increase in visible damage. The last four pests can all be controlled by cultural measures, and the increase in damage was mainly due to shortage of labour. The predacious Elaterid, *Pyrophorus luminosus*, Ill., which was introduced against *C. smithi*, was still present in the more hilly regions [*cf. loc. cit.*].

There was a general decrease in the insect pests of sweet potato, maize, and cassava during the year, possibly partly owing to an increase in spraying or to the selection of uninfested planting material. Further experiments on the defoliation of sweet potato confirmed the results obtained in 1943–44 [*cf. loc. cit.*]; two defoliations carried out five and eight weeks after planting reduced the yield by 76 per cent., two carried out eight and twelve weeks after planting reduced it by 65 per cent., and one, twelve weeks after planting and three weeks before reaping, reduced it by 5 per cent. Fair control of *Alabama argillacea*, Hb., on

cotton, was obtained in some fields by spraying with lead arsenate ; *Platyedra gossypiella*, Saund., was again absent [*cf. loc. cit.*]. The Coccid, *Icerya purchasi*, Mask., appeared in numbers in a few localities, but the introduced Coccinellid, *Rodolia cardinalis*, Muls., was still present and controlled most of the infestations.

Local radiolaria earth (a silica dust) reduced infestation of seed maize by grain weevils when mixed with it at a concentration of 1 per cent., and controlled infestation when used at 2 per cent. ; it would probably, however, be cheaper to import a standard commercial material.

Watson (J. R.). **Distributional Notes on two Species of Thysanoptera.**—*Florida Ent.* **28** no. 3 p. 53. Gainesville, Fla., 1946.

The author reports the finding of *Taeniothrips atratus*, Hal., on double phlox in Maine in June 1945, and of *Frankliniella bratleyi*, Watson, on tuberoses [*Polianthes tuberosa*] in Georgia. He states that *T. atratus* had not previously been collected in North America [but *cf. R.A.E.*, A **20** 225 ; **25** 472], and that *F. bratleyi* was hitherto known only from Gainesville, Florida, where it was also taken on tuberoses.

Painter (R. H.) & Jones (E. T.). **The Hessian Fly Resistance of Pawnee Wheat.**—*J. Kans. ent. Soc.* **18** no. 4 pp. 130–149, 5 figs., 14 refs. Manhattan, Kans., 1945.

The results are given of several years' investigations on the resistance to *Mayetiola* (*Phytophaga*) *destructor*, Say, of Pawnee wheat, a strain of hard winter wheat selected from the progeny of the F_3 generation of a cross between Kawvale, which is resistant, and Tenmarq, which is not. In central Kansas (the hard-wheat belt [*cf. R.A.E.*, A **20** 43]), the percentages of plants and tillers infested were 50 and 75 per cent. lower, respectively, in Pawnee than in Tenmarq, the ability of infested plants to produce tillers and foliage was greater, and more plants were able to survive infestation. The yield was higher than that from Tenmarq and the difference increased directly with intensity of infestation ; the difference in the yield from uninfested or slightly infested plants over a wide variety of conditions averaged 17 per cent. The average weights and lengths of puparia of *M. destructor* were smaller in examples from Pawnee than in those from Tenmarq and smaller still in those from Kawvale ; the rate of development of the larvae was slower in Pawnee and Kawvale, and the rate of mortality appeared to be higher in Pawnee than in Tenmarq. In the soft-wheat belt, however, there was little difference in the percentage of infested plants of Pawnee, Kawvale and Tenmarq ; this geographical variation is attributed largely to the existence of different strains of the fly [*loc. cit.*]. There is evidence that the resistance of Pawnee and Kawvale in central Kansas may decrease owing to the westward spread and survival of strains of *M. destructor* that can infest them, but the ability of Pawnee to survive and recover from infestation is not greatly affected by differences in resistance to strains of *M. destructor*.

Hungerford (H. B.). **The Sweetpotato Leaf Beetle** *Typophorus viridicyaneus* **(Crotch) in Kansas.**—*J. Kans. ent. Soc.* **18** no. 4 pp. 154–155. Manhattan, Kans., 1945.

In September 1945, larvae of *Typophorus viridicyaneus*, Crotch, caused considerable damage to sweet-potato tubers in Kansas, where this Eumolpid had not hitherto been recorded. A list is given of 15 States from which it has been recorded in the literature and four others (including Kansas) in which it has been collected.

Miles (H. W.) & Miles (M.). **Changes in Wireworm Population associated with Cropping.**—*Ann. appl. Biol.* **32** no. 3 pp. 235–236, 6 refs. London, 1945.

Experience has shown that wireworm populations are reduced by cultivation, and it is generally considered that root crops provide particularly unfavourable conditions for them because the soil is cultivated frequently when the larvae are near the surface, and its bareness in the earlier part of the season reduces oviposition and survival of newly hatched larvae. Observations were therefore made in Cheshire in 1938–42 on the fluctuations in numbers of wireworms associated with crops receiving the maximum and minimum amounts of cultivation (potato and spring cereals, respectively). Sampling was carried out before and after cropping, and the larvae were removed from the soil samples by hand ; comparisons with results obtained by the method of Salt & Hollick [*R.A.E.*, A **32** 306] showed that, owing to the light sandy nature of the soil, very few larvae more than 5 mm. long were missed. Species of *Agriotes* were predominant. The plots intended for potatoes were dug during winter and early spring and ridged at planting time ; subsequent cultivation and earthing up kept them free from weeds and the potato foliage did not cover the soil until midsummer. Those intended for cereals were previously under roots or potatoes ; they were harrowed during the winter to destroy weeds and rolled after the appearance of the oat and wheat seedlings. The larval populations per acre before and after cropping in 27 plots of potatoes and 25 plots of spring cereals (wheat and oats) are given in tables. The mean rate of decrease was 43 per cent. in the former and 38 per cent. in the latter ; the difference was not statistically significant, but may represent some increased reduction in potato plots through digging and trenching. It is concluded that cultivation, especially where it is superficial, reduces populations less than was hitherto thought. Deep cultivation, such as digging, ploughing and disking, must injure many larvae and expose many to attack by birds, but most migrate from the surface soil as it begins to dry [**32** 81] and there are unlikely to be many present when the soil is broken down to a tilth. In fields under root crops in the early stages of growth, wireworms are generally found in the moist soil in the lower levels among the crop roots and are consequently not greatly disturbed by surface cultivation.

The results of observations in 1938–43 on the increase in numbers of wireworms in soil under grass for three, four or five years are also given in a table. They indicate that the populations increase only slowly during the first year or two under leys. Some evidence was obtained that the females do not move far from the place at which they emerged in order to oviposit.

Petherbridge (F. R.), Wright (D. W.) & Ashby (D. G.). **The Biology and Control of the Carrot Fly.**—*Ann. appl. Biol.* **32** no. 3 pp. 262–264, 1 fig. London, 1945.

Some of the results obtained in experiments in progress since 1941 on the bionomics and control of the carrot fly [*Psila rosae*, F.] in eastern England [*cf. R.A.E.*, A **32** 225, etc.] are given. Larvae of the first generation are sometimes very injurious to young seedling carrots and in 1944 destroyed all the seedlings in small plots in a field in which the adults were very numerous. The periods of maximum emergence of adults of the overwintered generation from fen soil in the Isle of Ely were 30th May–5th June in 1941, 15th–21st May in 1942, 4th–13th May in 1933 and 9th–23rd May in 1944 ; the periods were shorter on medium and light loam soils. The number of first-generation adults to emerge from carrots sown in mid-April, mid-May and early June showed a progressive decrease. The influence on intensity of infestation of vegetation providing thick shelter for the adult flies [*cf.* **31** 24 ; **32** 226] was confirmed by the fact that infestation of carrots in the inner parts of a large field was much

higher within a few yards of experimental strips of maize than at a greater distance from them.

The cultural control measures recommended comprise growing early crops as far as possible from main crops, delaying the sowing of main crops until the middle of May or later, lifting and destroying heavily infested roots in October, placing the roots in store in clamps at the end of October, sowing carrots in large fields where there is relatively little shelter, and trimming edges, dykes and nettle beds to reduce shelter. The bait-spray of sodium fluoride and molasses [**31** 230 ; **32** 225] was applied with good results over large areas in 1943 and 1944, but preliminary experiments with emulsified solutions of DDT applied to carrot foliage against the adult flies in 1944 [**34** 44–45] indicate that it will be more economical, and that it is also likely to be effective in gardens and allotments, where the abundant shelter prevents the successful use of the bait-spray.

ROEBUCK (A.). **The Carrot Fly in the Midlands.**—*Ann. appl. Biol.* **32** no. 3 pp. 264–265. London, 1945.

Outbreaks of the carrot fly [*Psila rosae*, F.] on carrots and celery in an area in Lincolnshire and Nottinghamshire and the measures adopted against it during the past 20 years are briefly described. Until 1928, experimental work was largely confined to control measures for use on allotments, where naphthalene was of considerable value as a repellent. Late sowing to avoid oviposition by the overwintered generation was recommended for field crops, and it became the general practice to sow in June ; some growers made very early sowings, but when these were sufficiently early to avoid attack, the plants ran to seed.

Celery is usually attacked by second-generation larvae, which tunnel in the base of the outer stalks and of the young ones as they appear and destroy them, but do not kill the plants. In field experiments in 1928 and 1929, four applications of powdered naphthalene at the rate of 281 lb. per acre made on 1st, 12th and 27th July and 14th August increased the yield by 25 per cent. Further outbreaks occurred in 1935 and 1943 ; infestation was slight in the latter year, but young plants were killed by first-generation larvae.

In 1930 and 1931, good control was obtained in some carrot fields treated three times with powdered naphthalene or creosote salts at the rate of 1 cwt. per acre between the last week in May and the middle of June. In 1931, however, several hot days followed the application of creosote salts and men working in the field were affected by the fumes. Furthermore, a crop that was sown on 28th April and treated with powdered naphthalene at the rate of 1 cwt. per acre on 26th May and 3rd June and at the rate of ½ cwt. per acre on 7th, 10th, 14th, 17th, 21st and 28th June was a total loss ; infestation was very severe, and in that district only crops sown later than 7th June were successful. In 1932, anthracene oil (green tar oil) mixed with North African phosphate at a concentration of 1 per cent. was found to be equally effective and less harmful to the operators. The recommended percentage of the oil was increased to 2 per cent. in 1934 and this concentration has given fair control ; it produces a slight stinging sensation when handled. Later work on the habits of the adult flies has already been noticed [*R.A.E.*, A **31** 24]. In preliminary trials with insecticides in sprays, pyrethrum and paradichlorbenzene were both very effective, but the latter killed the foliage ; a tar distillate wash and nicotine were of no value.

WILSON (G. F.). **Investigations on the Control of Carrot Fly** (*Psila rosae* **F.**) **in Gardens.**—*Ann. appl. Biol.* **32** no. 3 pp. 265–276, 7 figs., 5 refs. London, 1945.

An investigation of ways in which infestation of carrots by *Psila rosae*, F., might be reduced in gardens and allotments was carried out in southern England

in 1942–44. The experimental beds were 92 ft. long and 10 ft. wide, and were bounded on either the northern or the southern side, and in some cases also on other sides, by hornbeam hedges 8 ft. high. All the roots were examined in evaluating the results. Carrots sown between the end of March and the third week in June were attacked to about the same extent, but infestation decreased progressively on sowings made between the end of June and the third week in July. Its intensity, especially on early crops, was affected by climatic conditions, which influence both the activity and movements of the flies [*R.A.E.*, A **31** 24] and the rate of growth and attractiveness to ovipositing females of the plants. An early attack that coincided with a period of drought in 1943 resulted in heavy infestation, but the outbreak was arrested in other plots, which were subjected to overhead irrigation. Singling should not be delayed until the seedlings are more than ½-1 in. high, as otherwise attack is likely to be as severe as on plants sown during the peak emergence period; it should be carried out early in the day when the flies are inactive and followed by the consolidation of the soil along the rows. Where infestation is light, attacked seedlings should be burnt as the eggs are seldom distributed evenly, but the larvae will move along the rows if the plants first attacked do not provide enough food. Infestations were heaviest in beds protected from the prevailing wind by hedges to the south and west, and the heaviest occurred in 1943 in such a bed with a large patch of nettles, which also provide good shelter for the adults, at the eastern edge. In beds exposed on the south, the greatest number of unmarketable roots were nearest to the hedge. Although there was a daily movement of flies from the hedges to the carrot plants, many remained among carrot foliage during warm, still weather. The presence of hedges, especially privet and elm, near carrot crops increases losses from a light attack, since the plants are weakened by the removal of water from the soil by the hedge plants. Coarse weeds near the site should be cut back and potatoes, which also provide shelter for the adults, should not be situated in the vicinity of carrot beds. When the plants were left unthinned and unweeded, fewer eggs were deposited among them, but many roots were too small to be marketable, as a result of overcrowding and competition with weeds, and the beds also provided shelter for the flies.

A bait-spray of 0·8 per cent. sodium fluoride and 2·5 per cent. cane molasses in water [**31** 230] applied to the hedges adjoining one carrot bed on ten occasions against adults of the overwintered generation and eight against those of the summer one did not cause any marked reduction in damage; it is not suitable for use in gardens and allotments owing to the large number of applications necessary, the difficulty of correct timing, the abundance of alternative shelter, and the risk of injury to the foliage of hedge plants which in the experiments were severely scorched. Observations by other investigators indicating that there is little varietal difference in susceptibility of carrots to attack and that increased infestation results from delay in harvesting were confirmed.

The value of stretching twine treated with creosote above growing carrots to repel ovipositing females [**30** 520; **32** 226] was demonstrated in 1943 on allotments in London parks, where crops so treated were relatively undamaged, whereas neighbouring untreated crops were completely destroyed.

HEY (G. L.). **Apple Blossom Weevil and DDT.**—*Agriculture* **52** no. 12 pp. 554–557, 4 refs. London, 1946.

Experiments with DDT for the control of the apple blossom weevil [*Anthonomus pomorum*, L.] were continued [*cf. R.A.E.*, A **33** 171] in ten orchards in southern England in 1945. The results, based on the average percentage of capped blossoms, are given in a table. They showed that one application of a spray containing ½ lb. actual DDT (75 per cent. pure) per 100

gals. was satisfactory provided that it was applied at the breaking to burst stages of the buds. There was little advantage in doubling the concentration of DDT or in making two applications ; in one case two applications of ¼ lb. DDT per 100 gals. were more effective than two of 1 lb. The material used was a powder containing 10 per cent. DDT mixed with an easily wetted inert base and a wetting agent, but good results were also obtained with a preparation in paste form diluted to give the same DDT content. The powder was also satisfactory when added to a 7½ per cent. miscible oil spray and applied at bud-break. The trees should be thoroughly soaked with a coarse spray to ensure that the weevils already present are destroyed and that those that arrive later are killed before they oviposit ; it is now known that oviposition begins at bud-break. Although these DDT preparations are compatible with lime-sulphur or Bordeaux mixture, the application of a single combined spray at the breaking stage would be too early to be of value against scab.

Excellent control of *Plesiocoris rugicollis*, Fall., was obtained in two instances in which DDT was applied at the breaking stage and again about a week later.

NUNBERG (M.). *Acantholyda nemoralis* **C. G. Thoms. in Poland.** [*In Polish.*]—*Trav. Inst. polon. Rech. for.* (A) no. 46, 53 pp., 25 figs., 23 refs. Cracow, 1946. (With a Summary in English.)

Acantholyda pinivora, Ensl. (*nemoralis*, Thoms., *stellata*, Christ) all stages of which are described, occurs in pine forests throughout Poland and is abundant in the regions of Cracow and Upper Silesia, where some 77 sq. miles of forest is infested. Severe outbreaks took place in 1928–31 in some districts, and much damage was caused in 1942 in a large forest to the east of Cracow. Observations on the bionomics of the sawfly were carried out there in 1943. Its distribution in Poland is outlined and all stages are described. The life-cycle lasts up to three years, as most of the larvae remain in diapause in the soil over three winters. Pupation occurs in early spring, and the duration of the pupal stage varies with temperature. The adults usually appear in April and the period of flight and pairing lasts about a month, but is mostly completed between 10th and 30th April. In 1943, the females began to die out at the end of April and the last adults were observed on 20th May. The newly emerged adults first rest on the forest litter, and the males then fly and most of the females crawl to the crowns of the pines ; they pair on the trunks and the females deposit about 80 eggs on the needles. Usually only one egg is laid on one needle, though up to four were observed. Hatching occurs throughout May, and the larvae make their way to the tips of the previous year's shoots, where they spin a loose web and feed on the needles Many of the needles are only partly destroyed, though some fall to the ground. Young needles are attacked in the absence of old ones, but the buds are not. Feeding proceeds from the centre of the crown to the periphery and from the lower branches to the upper ones so that the tops of the crowns remain partly green even during a severe infestation. The larvae moult five times and are full-fed in the second half of June or in early July. They then crawl to the ground or drop on threads of silk, pass through the ground litter into the humus or the mineral soil, and bury themselves to a depth of up to 6 ins., where they enter a diapause. Some pupate in the two following springs, but the majority only in the third spring. In damp places, resting larvae occurred in the soil at a depth of about ½ in. among the roots of sedge-grass.

Some of the eggs were parasitised by *Trichogramma evanescens*, Westw., up to 18 examples of which developed in a single egg, and two Tachinids and one Ichneumonid, all unidentified, were reared from the larvae. A small percentage of larvae collected in different parts of the forest were attacked by an unidentified fungus, and over 50 per cent. of the larvae in two heavily infested plots were infected in June 1944 by an unidentified bacterial disease. Many adults on the ground litter and the trunks of the trees were attacked by *Formica rufa*,

L., and trees in infested stands within a radius of about 40 yards from the nests of this ant preserved much of their foliage. Its introduction into stands attacked by the sawfly is therefore recommended. Other natural enemies were wild boars, which dug out the larvae and pupae from the soil, and birds.

A. pinivora is a very persistent pest, which maintains itself for many years in a given area. Owing to the mode of development of the larvae, injury is most intense every third year. Though the larvae feed chiefly on the old needles, some of the young ones in new plantations are destroyed during outbreaks. The infestation checks the growth of the trees and renders them liable to attack by bark beetles, but the foliage is partly renewed after the larvae have left it by the development of shoots that would not normally have developed until the next spring, and to a small extent by the recovery of the partly consumed needles. The sawfly is commonest in pure or almost unmixed stands of pine, and its gradual increase in recent years in Poland has been favoured by this system of cultivation. It has apparently been carried eastwards by the prevailing winds from its chief breeding centres in Silesia, and has thus gradually infested new territories. Its spread is also thought to have been effected by railways.

The preventive measures recommended are the cultivation of mixed forests with an undergrowth of shrubs and grasses, which favour *Trichogramma* and other parasites, and selective felling, so that the age range of the trees does not become uniform. In laboratory experiments in 1942, a contact dust containing veratrin that had been successfully used against *Panolis flammea*, Schiff., in pine forests was ineffective against larvae of *A. pinivora*, but satisfactory results were obtained in field tests with a proprietary calcium-arsenite dust containing 11 per cent. arsenic trioxide, which was applied twice from an aeroplane at the rate of 45 lb. per acre. A detailed account of the operation is given.

Entomology.—*Rep. Dep. Agric. Sierra Leone 1944* pp. 9–10. Freetown, 1945.

In investigations on fruit-piercing moths in Sierra Leone in 1944, 77 per cent. of the 24,129 moths caught belonged to species of *Achaea* ; 64 per cent. of the total number were caught on mango and only 1½ per cent. on *Citrus*. Records additional to those in previous lists [*R.A.E.*, A **25** 254 ; **27** 271, etc.] are given of food-plants of larvae of some of the moths. In the early part of the year, a few swarms of *Schistocerca gregaria*, Forsk., appeared in the Eastern District bordering French Guinea, but little damage was done.

Mungomery (R. W.). **Report of the Division of Entomology and Pathology.**—*45th Rep. Bur. Sug. Exp. Stas Qd 1944–45* pp. 20–22. Brisbane, 1945.

During the year ending 30th June 1945, fairly large flights of *Dermolepida albohirtum*, Waterh., occurred throughout the northern sugar-cane districts of Queensland, mainly in October and early November in the areas of higher rainfall and in December and January in those with less [*cf. R.A.E.*, A **34** 1]. The resultant populations of larvae were high in some districts, but the actual damage was less severe than during recent years, owing to abundant rain, which enabled the cane to recover. There was a serious check in growth, causing an appreciable decline in the weight of cane produced, but an increase in the sucrose content early in the season largely compensated for this. Fumigation was possible only in well-drained fields ; lodging of cane prevented it in fields that were sodden early in the season. In the Mackay district, very light populations of larvae were present over an extensive area, and although the dry summer and autumn tended to accentuate their destructive effects, these were reduced by winter rains. In further small-scale tests, methallyl chloride [*cf.*

loc. cit.] caused no reduction in cane growth when applications were made to various types of soil in a normal fumigation period and followed by adequate rainfall. The Tachinid parasite of the genus *Prosena* [*cf. loc. cit.*], which was identified as *P. nigripes*, Curr., was again observed in the Goondi area but, its numbers were small and it did not give economic control.

The larvae of *Lepidiota frenchi*, Blkb., caused rather less damage to sugar-cane than for some years in the north, except in isolated localities, adequate rainfall during the spring and early summer of 1944 enabling the crops to grow in spite of attack, but infestation in the Mackay areas was apparently more extensive than for many years, and the damage was intensified by dry conditions during spring and summer. *Pseudholophylla furfuracea*, Burm., was reported to have caused the loss of 15,000 tons of cane in the Isis district during the preceding season. A high-speed rotary hoe, if used at the correct time, reduces the numbers of larvae of this Melolonthid to relatively harmless levels, and is cheaper than soil fumigation. Experiments confirmed that light-traps catch too few to afford any control [*cf.* **18** 361]. Populations of *Rhabdoscelus obscurus*, Boisd., were again comparatively low, in spite of heavy rainfall, probably owing to control by the giant toad [*Bufo marinus*] and the pre-harvest burning of cane crops carried out during the war years.

Hoppers from overwintered eggs of *Gastrimargus musicus*, F., in the Mackay district [*cf.* **34** 2] began to hatch in August. Those that hatched before November fed on the young cane in large numbers, but died without reproducing, whereas those that hatched later matured and were present in the cane fields in flying swarms in January 1945. Another generation of adults appeared in March-April, but most of these died without ovipositing. In general, the outbreak was less intense than that of the previous year, and there was little damage to either young or more advanced cane where growing conditions were reasonably good. The general eastward movement of the infestation continued. Individual egg-beds up to ten acres in extent were observed on waste land and grazing land, and as control of the hoppers would therefore have presented great difficulties, no regional control measures were instituted. Attempts were made to destroy individual swarms with arsenical sprays or baits or by burning. As the hoppers increased in size, they became more difficult to poison, and the best results were obtained when the baits were scattered very early in the morning, before the swarms began to move, or late in the afternoon. Eggs deposited in the Cairns district during February 1944 hatched in late September and early October, but the swarms caused negligible damage to crops and ultimately disappeared in the mountainous forest country to the west. Since there was no appearance of hoppers in the area during 1945, it is assumed that normal spring and summer rains reduced the locust to its former minor status. *Sarcophaga* (*Blaesoxipha*) *filipjevi*, Rohd., was bred from the adults and *Anthomyia illocata*, Wlk., from egg-pods in this district, and large numbers of mites were observed infesting the adults. In the Mackay area, *Scelio bipartitus*, Kieff., was bred from egg-pods in March, and was observed in the field in March–June, but neither this Scelionid nor two Dipterous parasites bred from adults and hoppers gave much control.

The wireworm, *Lacon variabilis*, Cand., was not abundant, but it caused some local injury to newly planted cane under the dry conditions of the central districts.

Monro (H. A. U.) & Delisle (R.). **Methyl Bromide Fumigation of Plant Products in Railroad Freight Cars with special Reference to Work supervised by the Dominion Department of Agriculture during 1944.**—*Sci. Agric.* **25** no. 12 pp. 794–816, 12 figs., 5 refs. Ottawa, 1945.

An account is given of work that was carried out in Canada in 1944 on the fumigation of the large consignments of plant products, imported by sea,

in order to free them from insect pests and to prevent the spread of the latter to other commodities during transit or storage, and of similar treatment of a few consignments for export. The fumigant used was methyl bromide or a proprietary mixture (Proxate) of methyl bromide and carbon dioxide (7 : 93) ; it is claimed that the carbon dioxide enables the dose of methyl bromide to be reduced, but this was not confirmed and the excess pressure caused by it sometimes necessitated resealing of the cars. Most of the treatments were made in steel railway freight cars, and treating the goods before they left the seaport was found to be preferable to treatment at their destination. The imports fumigated included shelled ground-nuts [*Arachis hypogaea*] from India and Nigeria, infested by *Tribolium castaneum*, Hbst., *Dermestes ater*, Deg., *Tenebroides mauritanicus*, L., *Necrobia rufipes*, Deg., *Oryzaephilus surinamensis*, L., *Ephestia kuehniella*, Zell., *Corcyra cephalonica*, Staint., and (in the case of Indian ground-nuts at Vancouver) *Plodia interpunctella*, Hb., and cotton-seed meal from Brazil infested by *Lasioderma serricorne*, F., and small numbers of *Tribolium castaneum* ; and the exports were chick peas (*Cicer arietinum*), grown in Mexico, and infested by *Bruchus* (*Callosobruchus*) *maculatus*, F., and wheat grown in the United States and chicory root from Montreal, both infested by *P. interpunctella*.

The effect of the construction of the freight cars on fumigation and methods of sealing them and applying the fumigant are described. It was found preferable to seal from the outside, so that any leak detected after sealing was accessible ; any insects that crawled into cracks or under the doors were prevented from escaping and were reached by the fumigant. The most satisfactory method of applying the fumigant was by means of tubing from cans or cylinders outside the trucks, and exposure lasted 16–24 hours, except in the case of cotton-seed meal, which tends to pack tightly in the bags and was successfully treated by exposure to 2·5 lb. methyl bromide per 1,000 cu. ft. for 36 hours at summer temperatures. A dose of 1½ lb. per 1,000 cu. ft. at temperatures above 60°F. was found effective on other commodities in trucks of the best type, and ½ lb. per 1,000 cu. ft. was added for every 5° drop in temperature below this at the time of application. A dosage of 3 lb. per 1,000 cu. ft. for 21 hours at temperatures of 32–50°F. in the freight car and 46–50° in the commodity gave complete control of the larvae of *P. interpunctella* in chicory root, including those boring deeply into the roots. Successful fumigation of grain was carried out at temperatures of 107°F. and wind velocities up to 20 miles per hour, and it is concluded that wind velocity has no effect on fumigation in trucks provided the latter are sound and well sealed. Treatment was completely effective in most of the 781 cars fumigated, the 15 failures comprising 13 due to the use of unsuitable cars and two due to lack of experience on the part of the operator.

After treatment, opening both doors wide for two hours was sufficient to disperse the gas under most conditions in summer, but high winds that caused a strong draught across the cars sometimes trapped the gas in the ends of the latter, and in cool damp weather and during rain or fog it was sometimes present in the free air of the car at a concentration of 35–50 parts per million only 4–6 feet from the doors 24 hours after they had been opened. No car was released for dispatch until it had been ventilated continuously for at least six hours. In warm weather, considerable numbers of insects were sometimes found on the outside of the roofs and walls, and some of these re-entered the cars during ventilation ; also insects were occasionally found flying from cars undergoing sealing to others that were being ventilated, but none of these movements was responsible for a fresh infestation.

Fumigation caused no alteration in taste or processing qualities of the commodities treated and left no significant residue.

Manzoor Abbas & Mohammad Afzal. **Cotton Jassid (*Empoasca devastans* Dist.) in the Punjab. VI. Species found on the Cotton Plant in the Punjab.**— *Indian J. agric. Sci.* **15** pt. 3 pp. 119–124, 4 refs. Delhi, 1946.

In the course of investigations on *Empoasca devastans*, Dist. [*cf. R.A.E.*, A **33** 386, etc.], it was found that samples of Jassids collected from cotton at Lyallpur almost always included small numbers of *E. kerri* var. *motti*, Pruthi, *E. minor*, Pruthi, and *E. punjabensis*, Pruthi, and a survey was therefore carried out from July to October, inclusive, in 1940–42 to determine the extent to which these species were present on cotton in different parts of the Punjab. It was found that the percentage of the population represented by *E. devastans* was low initially in some of the localities in which collections were made, but increased steadily and reached a high figure towards the end of the season, and that the other species were much more evident in the south-west of the Province than elsewhere. Of these *E. k. motti* predominated, except in three localities, in which *E. minor* was the most abundant ; *E. punjabensis* was taken in very small numbers and was probably only a casual visitor to cotton. *E. k. motti* was comparatively abundant in the early part of the season and virtually absent at the end of it in certain localities, and a survey of crops growing near cotton showed that guara (*Cyamopsis psoraloides*), which is grown both as fodder and as green manure, was very heavily infested by it. When the manure crop is dug into the soil the adult Jassids migrate to other plants, including cotton, but a comparatively high population was not found to persist on cotton for more than a fortnight. In experiments in 1942, few nymphs hatched on cotton as compared with guara, though nymphs completed their development normally on it, so that the reduction in population is thought to be due to a low oviposition rate or possibly to a low rate of hatching.

E. minor is also thought to be associated with some fodder crop, and there is no evidence that either of these Jassids is injurious to cotton. *E. devastans* did not oviposit on guara, though a few nymphs completed their development on it.

Rahman (K. A.) & Amar Nath Sapra. **On the Biology of the Vegetable Mite (*Tetranychus cucurbitae* Rahman and Sapra : Fam. Tetranychidae).**— *Indian J. agric. Sci.* **15** pt. 3 pp. 124–130, 2 pls., 10 figs., 5 refs. Delhi, 1946.

Tetranychus cucurbitae, Rahm. & Sapra [*R.A.E.*, A **29** 271] is a serious pest of vegetable and other crops in the Punjab. It injures the leaves not only by sucking the sap but also by covering them with a thick web, which becomes filled with soil particles in windy weather and was shown to cause them to dry up. The resultant leaf-drop affects growth and flowering, and usually prevents the formation of fruit. From mid-December to March, the population consists almost entirely of gravid females ; these feed and sometimes oviposit on warm days. Successive generations overlap from March until July, when the monsoon rains kill all stages but the eggs. After the rains, the mites multiply rapidly until the cooler weather in November, when their numbers begin to decrease ; 32 generations per year were observed under controlled conditions. Parthenogenesis is common, unfertilised females giving rise to males only, whereas 80 per cent. of the progeny of fertilised ones are females. Males are about as numerous as females from May to September, more numerous in October and in March–April, and practically absent during December and January. The periods of maximum injury are May–July and September–October.

The authors give short descriptions of the immature stages of the mite and a list of its food-plants, the most favoured of which include cucurbits, beans, brinjal [*Solanum melongena*], *Canavalia ensiformis*, tomato and cabbage, and describe the cages in which its bionomics were studied. The food-plant was *C. ensiformis*. The males matured before the females, which pass through a

deutonymphal stage, and fertilised them as they emerged from it. Females and unmated males lived for 10–12 and 5–8 days, respectively, in April–September and 14–25 and 9–20 days in March and October–December, but males that had paired usually died within 24 hours. The preoviposition period was less than 24 hours in May–September but increased as the temperature fell and was sometimes a fortnight in late December and January. The eggs were deposited at random on the webbing, generally on the lower surface of the leaf. The oviposition period lasted 8–10 days in April–September and 12–20 days during March and October–December, fertilised females depositing 61–93 eggs, and unfertilised ones 33–59. The duration of the egg-stage was 2½–3 days between mid-April and mid-September and increased in cooler weather to a maximum of 30 days for eggs laid in January–February. Almost all eggs hatched except between the end of December and mid-February, and almost all the mites reached the adult stage. The period from hatching to adult varied from 1½–2 days for males and 2½–3 days for females in May–September to 20 and 27 days in January–February. Dispersal is chiefly by wind ; the females move about on the leaves for a time before they begin to feed and oviposit, and tend to collect in globular masses, which sometimes consist of more than 1,000 individuals and are easily dislodged by wind. They also migrate from one plant to another in contact with it.

HAVILAND (E. E.). **A Pest of Yucca,** *Halticotoma valida,* **Reut.**—*Bull. Md agric. Exp. Sta.* no. A37 pp. 103–112, 4 figs., 4 refs. College Park, Md., 1945.

During the summer, the leaves of *Yucca filamentosa* in Maryland show irregular yellowish patches due to the feeding of *Halticotoma valida,* Reut., which was first recorded there in 1935 and also occurs in States further south. During observations made in 1943–1944, the nymphs and adults were seen feeding together on either side of mature leaves. Population counts made on ten plants cut at ground level gave an average of 707 bugs per plant, and a ratio of males to females of 10 : 13.

The eggs and five nymphal instars of this Mirid are described. The nymphal stage lasted 23–29 days at laboratory temperatures ranging from 51 to 80°F. A pair of adults caged over egg-free plants mated a week after ecdysis. Oviposition was not observed, but nymphs appeared 2–3 weeks later and continued to do so for 10 days. Observations on several pairs indicated that a female probably deposits 50–100 eggs over a period of 7–14 days. There were three generations in the year ; overwintering eggs laid in October and November hatched in late April and early May. Eggs of the first and second generations were observed in the second week of June and the first week of August, respectively, and nymphs in the third week of June and mid-August. Adults of the three generations appeared at the end of May, in mid-July, and in the first week of September, and were present for approximately 4, 6 and 8 weeks, respectively. The insects became sluggish in autumn, and decreased gradually in numbers until the first hard frost killed all those that remained. Eggs were inserted into the tissue of the middle portion of full-grown leaves and were sometimes attacked by an undetermined Hymenopterous parasite.

All nymphs and most of the adults died within two days on plants dusted with 20 per cent. DDT in pyrophyllite, but some nymphs hatched on one plant subsequent to a second application of this dust and completed their development in the shelter of leaves that were bent down. All bugs were killed by a spray containing 1 per cent. DDT prepared by emulsifying a solution of DDT in xylol with Triton, and a single application gave protection for about two months, though a few eggs were deposited. The plants showed no injury due to the insecticide.

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LIBRARY LACUNAE.

The Institute will be greatly indebted to readers who may be able to supply any of the following, which should be sent to the Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7.

Acta Brevia Sinensia (London) : No. 3 (1943).
Agricultural Journal, Department of Agriculture, British Columbia (Victoria) : Vol. 1 (1916) Nos. 1 and 2.
Agricultural News (Barbados) : Nos. 1, 25, 26, 34, 66 (1902–04).
Agriculture and Animal Husbandry in India (Delhi) : 1937–38 and 1938–39.
Analele Institutului de Cercetări Agronomice al României (Bucarest) : Tome 14 (1942).
Anales de la Sociedad Científica Argentina (Buenos Aires) : Vols. 70 (1910) Nos. 2, 3, 4 ; 98 (1924) Nos. 5–6 ; 132 (1941) No. 5.
Annals of the Queensland Museum (Brisbane) : No. 5.
Annuaire et Mémoires du Comité d'Etudes Historiques et Scientifiques de l'Afrique Occidentale Française (Gorée) : Vols. 1–2 (1916–17).
Archiv für Schiffs- und Tropen-Hygiene (Leipzig) : Bd. 17 (1913) Heft 9.
Archives de l'Institut Pasteur de Tunis (Tunis) : 1906–09 ; 1910 fasc. 1–3 ; 1911 fasc. 3–4.
Arquivos do Instituto Bacteriologico Camara Pestana (Lisbon) : Vols. 1–2 (1906–10) ; 3 (1911) No. 1.
The Bee World (Benson, Oxon) : Vols. 1–2 (1919–21).
Biological Bulletin of the Marine Biological Laboratory (Woods Hole, Mass.): Vols. 1–2 (1899–1901) ; 23 (1912) ; 24 (1912) No. 2 ; 25 (1913) Nos. 5–6 ; 26 (1914) Nos. 1–2 ; 27 (1914) No. 4 ; 28 (1915) No. 1 ; 29 (1915) No. 5 ; 30 (1916) Nos. 2–3 ; 31 (1916) Nos. 4 & 6 ; 32–33 (1917) ; 34 (1918) Nos. 1–4 & 6 ; 35 (1918) ; 36 (1919) Nos. 2–3 ; 37 (1919) Nos. 4 & 6 ; 38 (1920) Nos. 1, 2, 5 & 6 ; 39 (1920) Nos. 4–6 ; 40 (1921) Nos. 1–4 & 6 ; 41 (1921) Nos. 2 & 3 ; 42 (1922) Nos. 1–3.
Boletín de la Dirección de Estudios Biológicos (Mexico) : Tomos 1–2 (1924–25).
Boletín de la Oficina Sanitaria Panamericana (Washington, D.C.) : Vol. 22 (1943) Nos. 2–12.
Bulletin Agricole de l'Algérie-Tunisie-Maroc (Algiers) : Année 20 (1914) Nos. 7–9, 12–14.
Bulletin du Comité d'Etudes Historiques et Scientifiques de l'Afrique Occidentale Française (Paris) : Année 1919 No. 1.
Bulletin of the Stoneham Museum (Kitale) : Nos. 37, 41.
California Agricultural Experiment Station (Berkeley, Cal.) : Circulars 14 and 42 (1905–09).
Caribbean Forester (New Orleans, La.) : Vol. 1 (1940) No. 1.
Chacaras e Quintaes (São Paulo) : Indices to Vols. 10, 11, 12, 14 ; and 42 (1930) No. 3.
Comptes Rendus des Séances de l'Académie d'Agriculture de France (Paris) : Tome 8 (1922) No. 5.
East African Agricultural Journal (Nairobi) : Vol. 5 (1939–40).
East African Medical Journal (Nairobi) : Vol. 22 (1945) No. 7.
Egatea, Revista da Escola de Engenharia de Porto Alegre, Brazil (Porto Alegre): Vols. 1–6 (1916–21) ; 7 (1922) Nos. 1–5 ; 8 (1923) Nos. 2–5 ; 9 (1924) Nos. 1, 4–6.
Egypt. Ministry of Agriculture (Cairo) : Bulletins 158, 162, 170–172, 174, 204, 212, 215, 227 (1938), 228, 230, 232, 235.
Entomologische Litteraturblätter (Berlin) : 6 Jahrg. (1906) Nos. 2 & 10.
Experiment Station Record (Washington, D.C.) : Vols. 1–4 (1889–94).
La Forêt Québecoise (Quebec) : Vol. 1 (1939) Nos. 1, 4, 6, 10 ; 2 (1940) Nos. 1, 3, 6.
Georgia State Board of Entomology (Atlanta, Ga.) : Bulletins 2, 6, 22 & 28 ; Circulars 1–3, 12, 15–18 & 20.
Hong Kong. Botanical and Forestry Department : Report for 1939.
India : Forest Research Institute (Dehra Dun) : Forest Bulletin (Old Series) ; Nos. 1–3.
India : Imperial Council of Agricultural Research (Delhi) : Annual Report for 1939–40.
Indian Central Jute Committee : Agricultural Research Laboratory (Calcutta): Annual Report 1941–42.
Indian Journal of Agricultural Science (Calcutta) : Vols. 9 (1939) No. 6 ; 10 (1940) Nos. 2–6 ; 11 (1941) Nos. 1–2 ; title-page & index to Vol. 12.
Indian Lac Research Institute (Namkum) : Report for 1942–43.
Indian Medical Gazette (Calcutta) : Vols. 50 (1915) No. 10 ; 51 (1916) Nos. 1–7, 10 ; 52 (1917) No. 7 and title-page & index ; 53 (1918) ; 54 (1919) No. 2 ; title-page & index to Vol. 76 (1941) ; 77 (1942) No. 8 ; 78 (1943) Nos. 1 & 10.
Indiana : Third Annual Report of the State Entomologist, 1909–10.

LIBRARY LACUNAE—*cont.*

Jamaica Department of Agriculture (Kingston) : Bulletin No. 31 (1941) ; Annual Report 1903–04, 1907–08, 1909–10, 1911–12.

Journal of Agricultural Research (Washington, D.C.) : Vol. 59 (1939) Nos. 2, 4, 5, 11, 12 ; 61 (1941) No. 3.

Journal of the Board of Agriculture of British Guiana (Demerara) : Vol. 3 (1909) No. 1 ; title-pages and indices to Vols. 1–2.

Journal of the South-Eastern Agricultural College (Wye, Kent) : Nos. 1–6, 8, 11–13 (1895–1904).

Kansas Agricultural Experiment Station (Manhattan, Kans.) : Circulars 5 (1909), 202 (1940) ; Bulletins 10 (1890), 77 (1898), 174 (1911).

Kentucky Agricultural Experiment Station (Lexington, Ky.) : Bulletins 21 (1889), 31 (1890), 47 (1893), 53 (1894), 74 (1898) and 91 (1901).

The Kenya and East African Medical Journal (Nairobi) : Vol. 2 (1925) Nos. 2–3.

Meditzinskaya Parazitologia i Parazitarnuie Bolezni (Moscow) : Vol. 1 (1932) No. 1.

Missouri Agricultural Experiment Station (Columbia, Mo.) : Bulletins 11 (1890), 13 (1891), 30, 31 (1895), 37 (1897), 50 (1900), 68 (1905), 96 (1911), 101, 105 (1912), 134 (1915), 457 (1942).

Natuurhistorisch Maandblad (Maastricht) : Jaarg. 1 (1912) ; 2 (1913) Nos. 1–4, 6–9 ; 5 (1916) Nos. 3–4 ; 7 (1918) Nos. 6–9 ; 8 (1919) No. 4.

New Jersey State Department of Agriculture (Trenton, N.J.) : Bulletin 2 ; Circulars 2, 12, 29 (1917–19).

New York State Museum (Albany, N.Y.) : Bulletins 26 & 57 (1899–1902).

Ontario Entomological Society Report (Toronto) : 9th (1878).

Ormerod (E. A.). Observations of Injurious Insects and Common Farm Pests during the Years 1877 & 1878 (London, 1878–79).

Peru. Ministerio de Agricultura. Estación Experimental Agrícola de la Molina (Lima) : Informe 56 (1943) ; Boletín 24 (1943) ; Circular 61 (1943).

Philippine Agriculturist and Forester (Manila) : Vols. 2 (1912) Nos. 1–3 ; 3 (1914) Nos. 1 & 2 ; 4 (1915) No. 4.

Philippine Journal of Agriculture (Manila) : Vols. 9 (1938) No. 3 ; 10 (1939) No. 3 ; 11 (1940) Nos. 1–3.

Philippine Journal of Science (Manila) : Vols. 1 (1906) No. 10 ; 72 (1940) No. 4.

Porto Rico Department of Agriculture, etc. (San Juan) : Journal, Vol. 1 (1917) No. 3.

Psyche (Boston, Mass.) : Vols. 11 (1904), 13 (1906), 16 (1909).

Public Health Reports (Washington, D.C.) : Vol. 55 (1940) Nos. 45, 52.

Punjab Department of Agriculture (Lahore) : Reports for 1938–41.

Review of U.S. Patents Relating to Pest Control (Washington, D.C.) : Vols. 16 (1943) No. 8 ; 17 (1944) Nos. 3 & 6.

Revista de Agricultura de Puerto Rico (San Juan) : Vols. 1 (1918) Nos. 1–2 ; 2 (1919) Nos. 5–6 ; 3 (1919) Nos. 3–4 ; 8 (1922) No. 2 ; 9 (1922) Nos. 5–6 ; 10 (1923) Nos. 1, 5, 6 ; indices to vols. 6–16.

Revista Chilena de Historia Natural (Santiago) : Año 14 (1910) Nos. 4–6 ; 15 (1911) Nos. 1 & 3 to end ; 16, 18, 26 (1912, 1914, 1922).

Revista Facultad de Agronomía Colombia (Medellin) : No. 1 (1939).

Revista de Medicina Tropical y Parasitología (La Habana) : Tomos 1–3 (1935–37) ; 4 (1938) No. 2.

Revista de Medicina, Veterinaria y Parasitología (Caracas) : Vol. 1 (1939) No. 2 to end ; title-page & index to Vol. 2.

Revista del Museo de la Plata (N.S.) Sección Zoologia (Buenos Aires) : Tomo 1 (1937) Nos. 3–4.

Revista de Veterinaria e Zootechnia (Rio de Janeiro) : Tomos 1–2 (1911–12) ; 3 (1913) Nos. 1–3 & 5.

La Révue de Phytopathologie Appliquée (Paris) : Tome 1 (April-May, 1914) Nos. 22–23.

Rhodesia Agricultural Journal (Salisbury) : Vols. 1 Nos. 1, 3–6 ; 2 Nos. 2–4 ; 3 Nos. 1, 2, 6 ; 4 No. 4 ; 5 (1903–08) No. 4 ; 7 (1909–10) Nos. 1 & 6 ; 9 (1912) No. 5 ; 10 (1912) No. 1 ; title-pages & indices to Vols. 1–5, 7, 8, 10.

Sciencia Medica (Rio de Janeiro) : Anno 1 (1925) Nos. 2–3, 5–6 ; 2 (1926) Nos. 1–10, 12.

Soap & Sanitary Chemicals (New York, N.Y.) : 20 (1944) No. 9 ; Blue books 1944 and 1945.

South London Entomological and Natural History Society : Reports 1879–84.

Tennessee Agricultural Experiment Station (Knoxville, Tenn.) : 10th (1897), 12th (1899) and 16th (1903) Annual Reports.

Tennessee State Board of Entomology (Knoxville, Tenn.) : Bulletins 15, 24, 25, 28, 29, 34, 39.

Teysmannia (Batavia) : 32ste Jaarg. (1921) 10e Afl.

Tijdschrift over Plantenziekten (Wageningen) : Jaarg. 1 (1895) and 16–17 (1910–11).

Timehri : The Journal of the Royal Agricultural and Commercial Society of British Guiana (Demerara) : Third Series, Vols. 1 Nos. 1–2 ; 2 No. 2 to end ; 3 No. 2 to end ; 4–5 (1911, 1913–18).

Travancore Department of Agriculture (Trivandrum) : Report for 1931–32.

Tropicheskaya Meditzina i Veterinariya (Moscow) : God 1 (1930) Nos. 2–5.

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(1329) Wt. P10/3764 2/47 S.E.R. Ltd. Gp. 432.